A
DISQUISITION
ABOUT THE
Final Cauſes
OF
NATURAL THINGS:

Wherein it is Inquir'd,
Whether, And (if at all) With what
Cautions, a Naturaliſt ſhould admit Them?

Boyle

By T.H. *R. B.* Fellow of the Royal Society.

To which are Subjoyn'd, by way of
APPENDIX
SOME
Uncommon Obſervations
ABOUT
VITIATED SIGHT.

By the ſame *AUTHOR*.

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THE

PREFACE.

THere are not many Subjects in the whole compaſs of Natural Philoſophy, that better deſerve to be Inquired into by Chriſtian Philoſophizers, than That which is Diſcours'd of in the following Eſſay. For Certainly it becomes ſuch Men to have Curioſity enough to Try at leaſt, Whether it can be Diſcover'd, that there are any Knowable *Final Cauſes*, to be Conſider'd in the Works of Nature. Since, if we neglect this Inquiry, we live in danger of being Ungrateful, in Overlooking thoſe Uſes of Things, that may give us Juſt Cauſe of Admiring and Thanking the Author of them, and of Loſing the Benefits, relating as well to Philoſophy as Piety, that the Knowlege of them may afford us. And if there be no ſuch Things, we are more than in danger to Miſpend our Labor and Induſtry, in fruitleſs

Searching for ſuch Things as are not to be Found. And an Inqury of this kind is now the more Seaſonable, becauſe two of the Chief Sects of the modern Philoſophizers, do both of them, though upon differing Grounds, deny that the Naturaliſt ought at all to trouble or buſie himſelf about *Final Cauſes*. For *Epicurus*,* and *moſt* of his Followers (for I except ſome few late ones, eſpecially the Learned *Gaſſendus*) Baniſh

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* *Illud in his rebus vitium vehementer ineſto, Effugere illorumque Errorem premeditemus, Lumina qui faciunt Oculorum clara Creata Proſpicere ut poſſimus* —— *Lucr. de rer. nat. lib. IV. ſect. 822.*

the

the Conſideration of the Ends of Things; becauſe the World being, according to them, made by Chance, no Ends of any Thing can be ſuppos'd to have been intended. And on the contrary, * *Monſieur Des Cartes*, and moſt of his Followers, ſuppoſe all the Ends of God in Things Corporeal to be ſo Sublime, that 'twere Preſumption in Man to think his Reaſon can extend to Diſcover them. So that, according to theſe Oppoſite Sects, '*tis* either Impertinent for Us to Seek after *Final Cauſes*, or Preſumptuous to think We may Find Them. Wherefore, I hope I ſhall be Excus'd, if, having been engag'd by ſome Sollicitations, (wherewith 'tis needleſs to trouble the Reader,) I did not Decline to Try, what the Bare, but Attentive, Conſideration of the Subject would Suggeſt to My Own Thoughts. And, *tho*' 'twas eaſie to Foreſee, by this means my Friend might miſs of receiving in my Eſſay, divers things that occurr'd not to Me; *yet* I conſider'd on the other ſide, that ſuch *things* would, notwithſtanding my Silence, be found in the Authors that deliver'd them: and 'twas very poſſible, that by the Courſe I took, I might light upon ſome Thoughts, that I ſhould have miſs'd, if I had prepoſſeſs'd my Mind with the Opinions of Others; which I was the leſs Tempted to do, becauſe an eaſie proſpect of my Theme ſuffic'd to let me ſee, I was like to have the *Epicureans* and *Carteſians* for my Aderſaries, not my Aſſiſtants. And for the School-Philoſophers; the very Slight Account that their Maſter *Ariſtotle* gives of One of my Four Queſtions, (for of the reſt, as far as I remember, He ſays little or nothing,) gave me ſmall hopes of being Aided by Them; eſpecially ſince in This, as in many Other Queſtions, they proceed upon Grounds that I cannot Aſſent to. Anatomiſts indeed, and ſome Phyſicians, have done very laudably upon the Uſes of the Parts of the Human Body; which I take this Occaſion to Declare, that it may not be Suſpected, that I do in the leaſt Undervalue their happy Induſtry, becauſe I Tranſcribe not Paſſages out of their Books: The Reaſons of which Omiſſion are, not only, That I had not any one Book of Anatomy at hand, when I was Writing; but, That the Uſes of the Parts of Man's Body related but to a ſmall Part of my Diſcourſe: to make which more Comprehenſive, I took in the Conſideration of more General Queſtions, beſides that which was controverted between *Ariſtotle* and the Ancienter Philoſophers, who diſputed how Bodies, that were devoid of Knowledg, could Act for Ends.

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* *Ita denique nullas unquam rationes circa res naturales, a fine, quem Deus aut Natura in iis faciendis ſibi propoſuit, deſumemus; qui non tantum nobis debemus arrogare ut ejus conſiliorum participes eſſe putemus. Carteſius Princip. Philoſoph. Parte prima Artic. 28.*

Thoſe that Reliſh no Books in Natural Philoſophy but ſuch as abound in Experiments, are ſeaſonably Advertis'd, that I do not Invite Them to Read this

Treatiſe; wherein I thought it much more Suitable *to* the Nature of my Subject and Deſign, to declare the Works of God, than of Men; and conſequently to Deliver rather Obſervations, than Artificial Experiments. And even of the Former of theſe, tho' perhaps moſt Readers may find in the enſuing Diſcourſe Several that they have not met with in Claſſic Authors, yet I ſhall freely acknowledge, that, upon the Review I made of what I writ, I find, tho' too Late to Repair the Omiſſion, that I have left ſeveral Things unmentioned, that would have been very pertinent to my Subject; which may, I hope, be more eaſily Excus'd, becauſe, the Body of the following Diſquiſition having been Written many years ago, and Thrown by upon the Death of the * Gentleman that Preſs'd me for it; I could not then take notice of thoſe many Diſcoveries in Anatomy, and o-

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* Mr. *Henry Oldenburgh*, Secretary of the Royal Society.

ther Parts of Phyſiology, that have ſince been happily made. But perhaps ſome will think, I may have more need to Excuſe the Largeneſs of Some Parts of the following Treatiſe, compar'd with the Others. And I ſhould rather Grant than Anſwer the Objection, if I could not Alledge, that the Contagious Boldneſs of ſome Baptiz'd *Epicureans*, Engag'd me to dwell much longer on the Third Propoſition of the Fourth Section, than I at firſt Intended. And on the other hand, the *Carteſian* Opinion having of late made it Requiſite to Handle the formerly Difficult Queſtion, about the Conſideration of *Final Cauſes*, after a New Manner; I thought it Unfit, Lightly to Paſs over the Paradox Maintain'd by ſo Great a Man; and Judg'd it Expedient in Some Places (what I could not do without Enlarging) to Propoſe Thoughts adjuſted to to the Preſent State of Things in this Affair: in the Management of which, I have had ſo much more

Regard to ſome Other Things, than to the Symmetry of the Parts whereof this Tract conſiſts, that I will not ſay, That *I fear*, I have in It but *Thrown together* Materials for a Juſt Diſcourſe on my Subject; ſince to *Do ſo* was the Main Thing I Intended. And if the Materials be Good and Solid, they will eaſily, in ſo Learned an Age as This, find an Architect, that will Diſpoſe them in a more Artful Way, than I was either at Leiſure or Sollicitous to do.

AN ESSAY, INQUIRING

Whether and How a Naturaliſt ſhould Conſider Final Cauſes.

To my very Learned Friend Mr. *F. O.*

SIR,

THough in a Book or two of mine, that you have already been pleas'd to peruſe, there are ſome paſſages, whence you may eaſily enough gather, what I thought about your Queſtions;

yet becauſe the Subject is of great moment, as well as difficulty, and you may ſuſpect I have alter'd my opinion, I ſhall, without referring you to writings, which perhaps neither you nor I have at hand, ſet down ſuccinctly, but yet as if I had ſaid nothing of any of them before, my preſent thoughts about theſe Four Queſtions.

I. Whether, generally or indefinitely ſpeaking, there be any Final Cauſes of things Corporeal, knowable by Naturaliſts?

II. Whether, if the firſt Queſtion be reſolv'd in the Affirmative, we may conſider Final Cauſes in all ſorts of Bodies, or only in ſome peculiarly qualified ones?

III. Whether, or in what ſenſe, the Acting for Ends may be aſcrib'd to an Unintelligent, and even Inanimate Body?

IV. And laſtly, How far, and with what Cautions, Arguments may be fram'd upon the ſuppoſition of Final Cauſes?

SECT. I.

TO begin with the firſt Queſtion; Thoſe that would exclude Final Cauſes from the conſideration of the Naturaliſt, are wont to do it (for ought I have obſerv'd) upon one of theſe two Accounts: *Either*, that with *Epicurus* they think the world was the Production of Atoms and Chance, without any intervention of a Deity; and that conſequently 'tis improper and in vain to ſeek for Final Cauſes in the effects of Chance: *Or*, that they judge with *Des Cartes*, that God being an Omniſcient Agent, 'tis raſh and preſumptuous for men to think, that they know, or can inveſtigate, what Ends he propos'd to himſelf in his Actings about his Creatures. The Ground on which the *Epicureans* have rejected Final Cauſes, has been diſallow'd by the Philoſophers of almoſt all other Sects; and ſome have written ſufficient Confutations of it, which therefore I ſhall here forbear to inſiſt on; though ſomethings I ſhall upon occaſion obſerve, that may help, if not ſuffice, to diſcredit ſo unreaſonable an Opinion. But the *Carteſian* Argument has been ſo prevalent among many Learned and Ingenious men, that it will be worth while (if it be but to excite better Pens) to ſpend ſome time in the Conſideration of it.

Perhaps one thing that alienated that excellent Philoſopher, from allowing the Conſideration of *Final* Cauſes in Phyſicks, was, that the School-Philoſophers, and many other Learned men, are wont to propoſe it too unwarily, as if there were no Creature in the world that was not ſolely, or at leaſt chiefly, deſign'd for the Service or Benefit of *Man*: Inſomuch that I remember I have ſeen a Body of Divinity, publiſh'd by a famous Writer, wherein, to prove the opinion he favours, of thoſe that would have the world annihilated after the day of Judgement, he urgeth this Argument; That ſince the World was made for the ſake of Man in his travelling Condition (*homini viatoris cauſa*,) when once Man is poſſeſs'd of his Everlaſting State of Happineſs or Miſery., there will be no further uſe of the World. The opinion, that gives riſe to ſuch preſumptuous and unwarrantable Expreſſions, did, as I gueſs by his objection, more *choque Des Cartes*, than I wonder that it ſhould diſpleaſe him. But the indiſcretion of men ought not to prejudice Truth; which muſt not be caſt away, with the unwarrantable Conceits that ſome men have pinn'd upon it.

Wherefore, ſince I cannot entirely cloſe, either with the opinion of the *Epicureans*, or of the *Carteſians*, I ſhall leave each party to maintain its own opinion, and proceed to propoſe mine: For the clearing of which, and indeed of the Diſquiſition of *Final Cauſes*, I ſhall beg leave to premiſe a Diſtinction, which, though novel, I ſhall venture to employ, becauſe it compriſes and diſtinguiſhes ſome things, which I think, ought neither to be overlook'd nor confounded.

I conceive then, that when we ſpeak of the Ends which Nature, or rather the Author of Nature, is ſaid to have in things Corporeal, One of theſe four things may be ſignify'd, or, if you like that expreſſion better, the End deſign'd by Nature may be fourfold:

Firſt, there may be ſome grand and General Ends of the whole World, ſuch as the Exerciſing and Diſplaying the Creators immenſe Power and admirable Wiſdom, the Communication of his Goodneſs, and the Admiration and Thanks due to him from his Intelligent Creatures, for theſe his divine Excellencies, whoſe Productions manifeſt his Glory. And theſe Ends, becauſe they regard the Creation of the whole Univerſe, I call the *Univerſal Ends* of God or Nature.

Secondly, in a ſomewhat more reſtrain'd ſenſe, there may be Ends deſign'd in the number, fabrick, placing, and wayes of moving the great Maſſes of Matter, that, for their Bulks or Qualities, are conſiderable parts of the World; ſince 'tis very probable, that theſe bodies, ſuch as the Sun, Moon, and fixed Stars, and the Terraqueous Globe, and perhaps each of its two chief parts, the Earth and the Sea, were ſo fram'd and plac'd, as not onlyto be capable of perſevering in their own preſent ſtate, but alſo as was moſt conducive to the Univerſal Ends of the Creation, and the good of the whole World, whereof they are notable parts. Upon which account theſe Ends, may, for diſtinctions ſake, be call'd *Coſmical* or *Syſtematical*, as regarding the Symmetry of the great Syſtem of the world.

There is a *Third* ſort of Ends, that do more peculiarly concern the Parts of Animals (and probably Plants too) which are thoſe, that the particular parts of Animals are deſtinated to, and for the welfare of the whole Animal himſelf, as he is an entire and diſtinct Syſtem of organiz'd parts, deſtinated to preſerve himſelf and propagate his *Species*, upon ſuch a Theatre (as the Land, Water or Air) as his Structure and Circumſtances determine him to act his part on. And theſe Ends, to diſcriminate them from others, may be call'd *Animal* Ends.

Fourthly, and laſtly, there is another ſort of Ends, which, becauſe they relate particularly to Man, may, for brevity's ſake, be call'd *Human* Ends, which are thoſe that are aim'd at by Nature, where ſhe is ſaid to frame Animals and Vegetables, and other of her productions, for the uſe of Man. And theſe Ends themſelves may be diſtinguiſh'd iuto *Mental*, that relate to His Mind, and *Corporeal*, that relate to His Body, not only as He is an Animal fram'd like other Animals, for his own Preſervation, and the propagation of his Species (Mankind;) but alſo as He is fram'd for Dominion over other Animals and works of Nature, and fitted to make them ſubſervient to the Deſtinations, that one may ſuppoſe to have been made of them to His ſervice and benefit.

This Diſtinction of *Final Cauſes*, which I hope will not prove altogether uſeleſs, being premis'd ; I ſhall begin my intended Diſcourſe, by owning a diſſent from both the oppoſite Opinions ; *Theirs*, that, with the vulgar of Learned Men, will take no notice of Final Cauſes but thoſe we have ſtiled *Human* ones ; and *theirs*, that (as they think, with *Deſcartes*) reject Final Cauſes altogether ; ſince, tho' I judge it erroneous to ſay in the ſtricteſt ſenſe, that every thing in the Viſible World, was made for the Uſe of Man ; yet I think 'tis more erroneous to deny, that any thing was made for ends Inveſtigable by Man.

'Tis a known Principle of the *Carteſian* Philoſophy, That there is always juſt the ſame quantity of Motion in the World at one time, that there is at another : Of which

Aſſertion this Reaſon is given; That there is no Cauſe, why God, who is Immutable, ſhould at the beginning of things, when he firſt put Matter into Motion, have given it ſuch a quantity of Motion, as would need to be afterwards augmented or leſſen'd. But I ſee not, how by this Negative way of Arguing, thoſe that imploy it, do not (implicitly at leaſt) take upon them to judge of the Ends, that God may have propos'd to himſelf in Natural things. For, without a Suppoſition, that they know what God deſign'd in ſetting Matter a-moving, 'tis hard for them to ſhew, that His Deſign could not be ſuch, as might be beſt accompliſh'd by ſometimes adding to, and ſometimes taking from, the Quantity of Motion he communicated to Matter at firſt. And I think it may be worth conſidering, Whether by this Doctrine of theirs, the *Carteſians* do not more take upon them than other Philoſophers, to judge of God's Deſigns. For, if a Man be known to be very Wiſe, and have various ways of compaſſing his ſeveral Ends, He that, ſeeing ſome of thoſe ways have a direct tendency to ſome Rational End, ſhall conclude That End to be one of thoſe that is intended, does thereby leſs preſume, and expreſs more reſpect to that Wiſe Man, than he that ſhould conclude, that thoſe cannot be his Ends, and that He can have no other Deſign knowable by us, except a certain General one nam'd by the Aſſertor. And indeed, it ſeems more eaſie to know, that this or that particular thing, for which an Engine is proper, may be *among others*, intended by the Artificer, tho' never ſo Skilful, than to know Negatively, that he can have no other than ſuch or ſuch an End.

And how will a *Carteſian* aſſure me, that among the many Ends, that he grants that God may have propos'd to himſelf in the Production of his Mundane Creatures; one may not be, That We, whom he has vouchſaf'd to make Intelligent Beings, and capable of Admiring and Praiſing him, ſhould find juſt cauſe to do ſo, for the Wiſdom and Goodneſs he has diſplay'd in the World? which Attributes we could not well diſcern or celebrate, unleſs we knew as well, that the Creatures were *made* for ſuch Uſes, as that they are exceedingly well *fitted* for them. I know God's Immutability is alledged, to prove that the Quantity of Motion is never vary'd: But to me 'tis not evident, why God's having particular Ends, tho' ſome of them ſeem to require a Change in his way of Acting in Natural Things, muſt be more inconſiſtent with his Immutability, than his Cauſing many things to be brought to paſs, which tho' *abæterno* he decreed to do, are yet not actually done, unleſs in proceſs of Time. And particularly it ſeems not clear, why God may not as well be Immutable, tho' he ſhould ſometimes vary the Quantity of Motion that he has put into the World, as He is, tho', according to the Opinion of moſt of the *Carteſians* themſelves, he does daily create multitudes of Rational Souls, to unite them to Human Bodies: Eſpecially conſidering, that theſe newly created ſubſtances, are, according to *Des-Cartes*, endow'd with a power, to determine and regulate the motions of the Spirits and the *Conarion*; which are things clearly Corporeal, I ſay not this, as if I abſolutely rejected the *Carteſian* Doctrine, about the continuance of the ſame Quantity of Motion in the whole Maſs of Matter. For, whether or no it be a Truth; I think 'tis no unuſeful nor improbable *Hypotheſis*: And I have not ſo much argued *againſt it*, as *upon the Grounds*, on which they argue *for it*.

Wherefore, to come now to the thing it ſelf, whereas Monſieur *Des-Cartes* objects, that 'tis a Preſumption for Man, to pretend to be able to inveſtigate the Ends, that the Omniſcient God propos'd to himſelf in the making of his Creatures; I conſider by way of Anſwer, That there are two very differing ways, wherein a Man may pretend to know the Ends of God in his viſible Works: For, he may either pretend to know only *ſome* of God's Ends, in ſome of his Works; or, he may pretend to know *all* his Ends. He that arrogates to himſelf, to diſcover God's Ends in this *latter* ſenſe, will ſcarce be excus'd from a high Preſumption, and no leſs a Folly, from the reaſon lately intimated in the *Carteſian* Objection. But to pretend to know God's Ends in the *former* ſenſe, is not a *Preſumption*, but rather, to take notice of them is a *Duty*. For, there are ſome things in Nature ſo curiouſly contrived, and ſo exquiſitly fitted for certain Operations and Uſes, that it ſeems little leſs than Blindneſs in Him, that acknowledges with the *Carteſians* a moſt wiſe Author of things, not to conclude, that, tho' they *may* have been deſign'd for *other*, and perhaps higher Uſes; yet they *were* deſign'd for *this* Uſe. As he that ſees the Admirable Fabric of the Coats, Humors, and Muſcles of the Eyes, and how excellently all the parts are adapted to the making up of an Organ of Viſion, can ſcarce forbear to believe, that the Author of Nature intended It ſhould ſerve the Animal, to which it belongs, to See with. The *Epicureans* indeed, that believe the World to have been produc'd but by the caſual concourſe of Atoms, without the intervention of any Intelligent Being, may have a kind of excuſe, whereof other Philoſophers are deſtitute, that acknowledge a Deity, if not alſo a Providence. For the very Suppoſition, for inſtance, that a mans Eyes were made by Chance, argues, that they need have no relation to a deſigning Agent; and the uſe that a man makes of them, may be either caſual too, or at leaſt may be an effect of *His* knowledge, not of *Nature's*. But when, upon the Anatomical Diſſection, and the Optical Conſideration, of a Human Eye, we ſee 'tis as exquiſitly fitted to be an organ of Sight, as the beſt Artificer in the world could have fram'd a little Engine, purpoſely and mainly deſign'd for the uſe of ſeeing; 'tis very harſh and incongruous to ſay, that an Artificer, who is too intelligent either to do things by chance, or to make a curious piece of workmanſhip without knowing what uſes 'tis fit for, ſhould not deſign it for an uſe to which 'tis moſt fit.

'Tis not to be deny'd that he may have more uſes for it than one, and perhaps ſuch uſes as we cannot divine; but this hinders not, but that, among its ſeveral uſes, this, to which we ſee it ſo admirably adapted, ſhould be thought one. And I ſee not, how it does magnifie Gods wiſdom, or expreſs our Veneration of it, to exclude out of the number of his Ends in framing Human Eyes, that moſt obvious and ready uſe which we are ſure is made of them, and which they could not be better fitted for. This may perhaps be not unfitly illuſtrated by the following Compariſon, whereof the application were ſuperfluous: Suppoſe that a Country Man, being in a clear day brought into the Garden of ſome famous Mathematician, ſhould ſee there, one of thoſe curious Gnomonick Inſtruments, that ſhow at once, the *place* of the *Sun* in the *Zodiack*, his *Declination* from the *Æquator*, the *Day of the Month*, the *Length of the Day*, &c. It would indeed be preſumption in him, being unacquainted both with the Mathematical Diſciplines, and the ſeveral Intentions of the Artiſt, to pretend or think himſelf able, to diſcover all the Ends, for which ſo Curious and Elaborate a Piece was framed. But when he ſees it furniſhed with a Stile, with Horary Lines and Numbers, and in ſhort, with all the Requiſites of a Sun *Dial*, and manifeſtly perceives the Shadow to mark from time time, the Hour of the Day; 'twould be no more a Preſumption than an Error in him to conclude, that (whatever other Uſes the Inſtrument is fit, or was deſign'd for) it is a Sun-*Dial*, that was meant to ſhew the Hour of the Day.

And here I ſhall demand of thoſe, that will not allow us to think, that any Natural Things are directed to Ends knowable by Men; whether, if the Divine Author of them had really deſign'd them for ſuch Ends, the things themſelves are not ſo Fram'd and directed, as in that caſe they ſhould be? And whether the Fabrick and Management of Natural Things, do really countenance or contradict our Suppoſition?

For my part, after what has been already diſcours'd, I ſcruple not to confeſs, that I ſee not why it ſhould be reputed a Diſparagement to the Wiſdom of any Agent whatſoever, to think, that his Productions were deſign'd for ſuch *Ends*, among others, as they are excellently fram'd and fitted for; unleſs it did appear, that thoſe Ends were unworthy to be Deſign'd by the Wiſe Agent. But that cannot be juſtly ſaid in our preſent Caſe; ſince 'tis not injurious to the Divine Author of things, to believe that *ſome* of the Ends, to which he deſtinated divers of his Corporeal Works, were; To exert and communicate His Exuberant Goodneſs, and to receive from his intelligent Creatures, ſuch as Men, an ardent Love, a high Admiration, and an obſequious Gratitude, for having diſplay'd ſo much Wiſdom and Beneficence, in exquiſitly qualifying his Works to be wonderfully ſerviceable to one another, and a great number of them to be particularly ſubſervient to the Neceſſities and Utilities of Man.

And indeed I can by no means aſſent to that Aſſertion of *Mr. Des-Cartes*, That it cannot be ſaid, that ſome of Gods Ends (in his Corporeal Works) are more manifeſt than others; but that all of them lie equally hid in the Abyſs of the Divine Wiſdom: ſince there are many of his Creatures, ſome of whoſe Uſes are ſo manifeſt and obvious, that the generality of Mankind, both Phi-

Nec fingi poteſt, aliquos Dei Fines, magis quàm alios, in propatulo eſſe; omnes enim in imperſcrutabili ejus ſapientiæ Abyſſo ſunt eodem modo reconditi. Reſp. Quart. ad Object. Gaſſendi.

Philoſophers and Plebeians, have in all Ages, and almoſt in all Countries, taken Notice of, and Acknowledg'd them. And as to what he adds, (by which he ſeems to intimate the motive that led him to make the foremention'd Aſſertion,) That in Phyſicks, all things ought to be made out by certain and ſolid Reaſons; to this I anſwer, *Firſt*, That I ſee not why the admitting, that the Author of Things deſign'd ſome of his Works for theſe or thoſe Uſes, amongſt others, may not conſiſt with the Phyſical Accounts of making of thoſe things; as a Man may give a Mechanical Reaſon of the Structure of every Wheel and other part of a Watch, and of their way of acting upon one another when they are rightly put together, and in ſhort, of the Contrivance and *Phænomena* of the little Machine; tho' he ſuppoſe, that the Artificer deſign'd it to ſhow the hours of the day, and tho' he have that intended uſe in his Eye, whilſt he Explicates the Fabrick and Operations of the Watch. I anſwer, *Secondly*, That I readily admit, that in Phyſicks we ſhould indeed ground all things upon as ſolid Reaſons as may be had; But I ſee no neceſſity, that thoſe Reaſons ſhould be always preciſely Phyſical: Eſpecially if we be treating, not *of* any particular *Phænomenon*, that is produc'd according to the courſe of Nature eſtabliſh'd in the *World*, already conſtituted as *this* of ours is: but *of* the firſt and general Cauſes of the World it ſelf; from which Cauſes, I ſee not why the Final Cauſes, or Uſes, that appear manifeſtly enough to have been deſign'd, ſhould be excluded. And to me 'tis not very material, whether or no, in Phyſicks or any other Diſcipline, a thing be prov'd by the peculiar Principles of that Science or Diſcipline; provided it be firmly proved by the common grounds of Reaſon. And on this occaſion let me obſerve, that the Fundamental Tenents of Mr. *Des-Cartes*'s own Philoſophy, are not by himſelf prov'd by Arguments ſtrictly Phyſical; but either by Metaphyſical ones, or the more Catholick Dictates of Reaſon, or the particular teſtimonies of Experience. For when, for inſtance, he truly aſcribes to God, all the Motion that is found in Matter; and conſequently, all the variety of *Phænomena* that occur in the World; he proves not by an Argument preciſely Phyſical, that God, who is an Immaterial Agent, is the efficient cauſe of Motion in Matter; but only by this, That ſince Motion does not belong to the Eſſence and nature of Matter, Matter muſt owe the Motion it has to ſome other Being: And then 'tis moſt agreeable to common Reaſon, to infer, that, ſince Matter cannot move it ſelf, but it muſt be mov'd by ſome other Being, that

Being muſt be Immaterial, ſince otherwiſe ſome Matter muſt be able to move it ſelf contrary to the *Hypotheſis*. And when *Des-Cartes* goes to demonſtrate, that there is always in the Univerſe, the ſelf-ſame quantity of Motion, (that is, juſt as much at any one time, as at any other) and conſequently, that as much motion as one Body communicates to another, it looſes it ſelf; he proves it, by the Immutability of God, which is not a Phyſical Argument ſtrictly ſo call'd, but rather a Metaphyſical One; as he formerly prov'd, God's being the Cauſe of all Motion in Matter, not by Principles peculiar to Phyſicks, but by the common grounds of Reaſon.

Tho' *Monſieur* *Des-Cartes* does, as I have formerly ſhown, ſpeak very Dogmatically and Univerſally, againſt

C'eſt une choſe qui de ſoy eſt manifeſte, que nous ne pouvons connoiſtre les fins de Dieu, ſi luy meſme ne nous les revele. Et encore

Mens endeavouring or pretending to know any Final Cauſes in Natural things; for which Reaſon I have, as well as the generality of his other Readers, and even his Diſciples, look'd upon the Senſe of thoſe poſitive Expreſſions as containing his Opinion; *yet*, ſince I writ the foregoing part of this Treatiſe, I lighted on a Paſſage of his, wherein he ſeems to ſpeak more cautiouſly or reſervedly, oppoſing His Reaſoning to Their

qu'il ſoit vray en Morale, en egard à nous autres hommes, que toutes choſes ont eſte faites pour la gloire de Dieu, à cauſe que les hommes ſont obligez de louer Dieu pour tous ſes ouvrages; & qu'on puiſſe auſſi dire, que le ſoleil à eſte fait pour nous eclairer, pour ce que nous experimentons que le ſoleil en effet nous eclaire: ce ſeroit toutes fois une choſe puerile & abſurde, d'aſſurer en Metaphyſique, que Dieu, à la facon d'un homme ſuperbe, n'auroit point eu d'autre fin en baſtiſſant le Monde, que celle d'eſtre louè par les hommes; & qu'il n'auroit creè le ſoleil, qui eſt pluſieurs fois plus grand que la Terre, à autre deſſein que d'eclairer l'homme, qui n'en occupe qu'une tres-petite partie.

Opinion who teach, that God hath no other End in making the World, but that of being prais'd by Men. But in that ſhort Diſcourſe whereof this Paſſage is a part, there are two or three other things wherein I cannot Acquieſce. As firſt, that 'tis Self-evident, that we cannot know the Ends of God, unleſs he Himſelf reveal them to us; (he muſt mean in a Supernatural way, if he will not ſpeak impertinently:) For what he ſays to be evident of it ſelf, is not at all ſo, to the generality of Mankind, and even of Philoſophers; and therefore I think, it ought not to be barely pronounc'd, but (if it can be) ſhould be prov'd. And next, he does not ſhow how we are oblig'd to praiſe God for his Works, if He had no intention to have us do ſo, or that we ſhould diſcover any of the Ends for which He made them. If a judicious Man ſhould ſee a great Book, written in ſome Indian Language, which he is utterly a Stranger to, and ſhould know nothing of it, but that 'twas made by a very Intelligent Phyſician: He might indeed conclude, that the Work was not made by chance, but would have no means to be convinc'd by the Inſpection of the Book it ſelf, that it was compos'd with great Skill and Kindneſs, and deſerv'd his Praiſe and Thanks: Since he could not know any of the particular Ends, to which the ſeveral Chapters of it were deſtinated, nor conſequently diſcover how skilfully they were fitted to reach ſuch Ends. What *Des-Cartes* ſays, that 'tis childiſh and abſurd to think, that God had created the Sun, which is many times bigger than the Earth, only to afford Light to Man, who is but a very ſmall part of It, is ſomewhat invidiouſly propos'd; there being few able Writers, that confine the Utility of the Sun directly to the affording Light to Man; and the littleneſs of his

Bulk, ought not to make it thought abſurd, that God may have had an eſpecial Eye to his Welfare, in framing that bright Globe; ſince not only, for ought appears to us, that moſt excellent Engine of Mans Body, is a more admirable thing than the Sun, but the rational and immortal Soul that reſides in it, is incomparably more noble than a thouſand Maſſes of brute Matter, and that not ſo much as Organiz'd, can be juſtly reputed, (as will be hereafter more fully declared.) And ſince in this very Diſcourſe, the accute Author of it confeſſes, that we may know the ends of God's Corporeal Works, if He reveal them to us; a Chriſtian Philoſopher may be allow'd, to think the Sun was made, among other purpoſes, to inlighten the Earth, and for the uſe of Man, ſince the Scripture teaches us, that not only the Sun and Moon, but the Stars of the Firmament, which *Des-Cartes* not improbably thinks to be ſo many Suns, were made to give Light to the Earth, and were divided to all the Nations that inhabit it. Deut. 4. 19.

Perhaps it were not raſh to add, that I ſee not why the Belief, that a Man may know ſome of God's Ends in things Corporeal, ſhould more derogate from our Veneration of his Wiſdom, than to think we know ſome of his Ends in other Matters, of which the Scripture furniſhes us with a multitude of Inſtances, as (particularly) that of *Job* ſacrificing for his Friends; and the declar'd Uſes of the *Urim* and *Thumim*: Since God may, if He pleaſes, declare Truths to Men, and inſtruct them, by his Creatures and his Actions, as well as by his Words: As when He taught *Noah* by the Rain-bow, and *Jonah* by a Gourd and a Worm, and regulated the Incampment of the *Iſraelites*, by the guidance of a Cloud, and a fiery

Pillar. Laſtly, whereas Monſieur *Des-Cartes* objects, that thoſe he diſſents from, talk as if they look'd upon God as a proud Man, who deſign'd his Works only to be prais'd for them; I know not, whether in this place he ſpeaks ſo cautiouſly and reverently of God, as he ought, and elſewhere is wont to do. For as Humility, tho' it be a Vertue in Men, is extreamly remote from being any of Gods Perfections, ſo That may be pride in a Man, who is but a Creature, imperfect, dependent, and hath nothing that he has not receiv'd; which would be none at all in God, who is uncapable of Vice, and who may, if he pleaſe, juſtly propoſe to himſelf His own Glory for one of his Ends, and both require and delight to be prais'd by Men for his Works; ſince he is moſt worthy of all praiſe, and 'tis their duty and *reaſonable ſervice*, which he is graciouſly pleas'd to approve of, to pay it Him.

'Tis not without trouble, that I find my ſelf oblig'd by the exigency of my deſign, ſo much to oppoſe, in ſeveral places of this preſent Diſcourſe, ſome Sentiments of *Mr. Des-Cartes*, for whom otherwiſe I have a great eſteem; and from whom I am not forward to diſſent. And this I the rather declare to you, becauſe I am not at all of Their mind, that think *Mr. Des-Cartes* a favourer of Atheiſm, which, to my apprehenſion, would ſubvert the very foundation of thoſe Tenents of Mechanical Philoſophy, that are particularly his. But judging that his Doctrine (at leaſt as it is underſtood by ſeveral of his Followers, as well as his Adverſaries;) about the rejection of Final Cauſes from the conſideration of Naturaliſts, tends much to weaken, (as is elſewhere noted) if not quite to deprive us of, one of the beſt and moſt ſucceſsful Arguments, to convince Men, that there is a God, and that they ought to Admire, Praiſe, and Thank him: I think it my duty *to* prefer an important truth, before my reſpect to any Man, how eminent ſoever, that oppoſes it; and *to* conſider more the Glory of the great Author of Nature, than the Reputation of any one of Her Interpreters.

And to ſtrengthen what I have been ſaying, give me leave to mind you more expreſly here, of what I have elſewhere Intimated, *viz.* That the excellent Contrivance of the great Syſtem of the World, and eſpecially the curious Fabrick of the Bodies of Animals, and the Uſes of their Senſories, and other parts, have been the great Motives, that in all Ages and Nations induc'd Philoſophers to acknowledge a Deity, as the Author of theſe admirable Structures; and that the Nobleſt and moſt Intelligent Praiſes, that have been paid

Him by the Prieſts of Nature, have been occaſion'd and indited by the Tranſcending Admiration, which the attentive Contemplation of the Fabrick of the Univerſe and of the curious Structures of Living Creatures, juſtly produc'd in them. And therefore it ſeems injurious to God, as well as unwarrantable in it ſelf, to baniſh from Natural Philoſophy, the Conſideration of Final Cauſes; from which chiefly, if not only, I cannot but think (tho' ſome Learned Men do otherwiſe) that God muſt reap the Honour that is due to thoſe glorious Attributes, his Wiſdom, and his Goodneſs. And I confeſs, I ſomewhat wonder, that the *Carteſians*, who have generally, and ſome of them skilfully, maintain'd the Exiſtence of a Deity, ſhould endeavour to make Men throw away an Argument, which the Experience of all Ages ſhews to have been the moſt Succeſsful, (and in ſome Caſes the only prevalent one) to eſtabliſh among Philoſophers the Belief and Veneration of God. I know the *Carteſians* ſay, That their Maſter has demonſtrated the Exiſtence of a God, by the *Innate Idea* that Men have of a Being infinitely perfect; who left it upon the mind of Man, as the mark of an *Artiſt impreſt upon his Work*: And alſo that they aſcribe to God, the having made Matter out of nothing, and alone put it into Motion; which ſufficiently argue the Immenſity of his Power. But, *tho'* I would by no means weaken the Argument, drawn from the *Inbred Notion* of God, ſince I know, that divers Learned Men have Acquieſc'd in it; *yet*, on the other ſide, I ſee not, why we may not reaſonably think, that God, who, as themſelves confeſs, has been pleas'd to take care, Men ſhould acknowledge Him, may alſo have provided for the ſecuring of a Truth of ſo great Conſequence, by ſtamping Characters, or leaving Impreſſes, that Men may know his Wiſdom and Goodneſs by, as well *without*, upon the *World*, as *within*, upon the *Mind*. The bare Speculation of the Fabrick of the World, without conſidering any part of it as deſtinated to certain (or determinate) Uſes, may ſtill leave Men unconvinc'd, that there is any Intelligent, Wiſe, and Provident Author and Diſpoſer of Things: Since we ſee generally the Ariſtotelians (before ſome of them were better Inſtructed by the Chriſtian Religion) did, notwithſtanding the Extent, Symmetry, and Beauty of the World, believe it to have been Eternal: And tho' They, whatever their Maſter thought, did not believe it to have been Created by God; yet, becauſe they aſſerted that Animals, Plants, *&c.* act for Ends, they were oblig'd to acknowledge a Provident and Powerful Being, that maintain'd and govern'd the Univerſe, which they call'd *Nature*:

Tho' they too often dangerouſly miſtook, by ſometimes confounding this Being with God himſelf; and at other times, ſpeaking of it as Co-ordinate with him, as in that famous Axiom of *Ariſtotle*, *Deus & Natura nihil faciunt fruſta.* I acknowledge therefore, that, as I ſet a juſt value upon the *Carteſian* Proof of God's Exiſtence, ſo I ſee no reaſon, why we ſhould disfurniſh our ſelves of any other ſtrong Argument to prove ſo noble and important a Truth; eſpecially, ſince the *Carteſian* way of conſidering the World, is very proper indeed to ſhew the Greatneſs of God's Power, but not, like the way I plead for, to manifeſt that of his Wiſdom and Beneficence. For, whereas a *Carteſian* does but ſhew, that God is admirably Wiſe, upon the ſuppoſition of his Exiſtence; in our way, the ſame thing is manifeſted by the Effect of a Wiſdom, as well as Power, that cannot reaſonably be aſcribed to any other, than a moſt intelligent and potent Being; So that by This way, Men may be brought, upon the ſame account, both to *acknowledge* God, to *admire* Him, and to *thank* Him.

SECT. II.

TO give you now my thoughts of the *ſecond* Queſtion, *viz. Whether we may conſider Final Cauſes in all ſorts of Bodies, or only in ſome peculiarly Qualify'd Ones.* I muſt divide Natural Bodies into *Animate* and *Inanimate*. The former of which Terms, I here take in the larger ſenſe of thoſe, who under it comprehend, not only Animals, but Vegetables; tho' I ſhall not diſdainfully reject the Opinion of thoſe Learned Men, that are unwilling to allow Plants a ſoul or life, at leaſt as properly ſo call'd, as that which is confeſſedly granted to Animals.

Of the *Inanimate* Bodies of the Univerſe, the Nobleſt, and thoſe which on this occaſion deſerve chiefly to be conſidered, are the Sun, Planets, and other Cœleſtial Bodies. For, when Men ſaw thoſe vaſt and luminous Globes, and eſpecially the *Sun*, move ſo conſtantly, and ſo regularly, about the Earth, and diffuſe on it Light and Heat; and by their various Revolutions produce day and night, Summer and Winter, and the Viciſſitudes of Seaſons, that are ſo opportune for the Inhabitants of the Earth: The obſervers, I ſay, of all this concluded, both that theſe Motions were guided by ſome Divine Being, and that they were deſign'd for the benefit of Man Whether this be a demonſtrative *Collection*, I ſhall not now debate; but I ſee not, why it may not have thus much of Probability in it; that in caſe a Man ſhall think, that the Fabrick of the Cœleſtial parts of the World, was the curious Production of an Intelligent and Divine Agent, the regular *Phænomena* of the Heavens will not contradict him; ſince there is nothing in that Fabrick that misbecomes a Divine Author; and the Motions and Operations of the Sun and Stars are not ſuch, but that they will allow us to think, that, among other purpoſes, they were made to Illuminate the Terreſtrial Globe, and bring Heat and other Benefits to the Inhabitants of it: So that the Contemplation of the Heavens, which ſo manifeſtly *declare the Glory of God*, may juſtly excite Men, both to admire his Power and Wiſdom in them, and to return him Thanks and Praiſes, for the great Benefits that accrue to us by them.

Pſal. 19. 1.

But now, on the other ſide, it may be ſaid, that in bodies *Inanimate*, whether the portions of Matter they conſiſt of be greater or leſſer, the Contrivance is very rarely ſo Exquiſite, but that the various Motions and Occurſions of the parts of Matter may be, without much Improbability, ſuſpected to be capable, after many Eſſays, to caſt one another into divers of thoſe Circumvolutions of Matter, that, I remember, *Epicurus* calls συστροφὰς and *Des-Cartes Vortices*; which being once made, may continue very long, by the means expreſs'd by *Carteſius*, or by ſome other as probable Ones. But, without allowing this *Hypotheſis* to be more than not very improbable, when I conſider, what Cauſes there may be to fear, that we are not yet ſufficiently acquainted with the true Syſtem of the World, and are not uſually ſenſible enough, how ſmall a part We, and the Terreſtrial Globe we inhabit, make of the Univerſe; I am apt to fear too, that Men are wont, with greater Confidence than Evidence, to aſſign the Syſtematical Ends and Uſes of the Cœleſtial Bodies, and to conclude them to be made and moved, only for the ſervice of the

Earth and its Inhabitants. And *tho'*, even as a meer Naturaliſt, I will not deny, that, as *Man* actually receives Benefits by the eſtabliſh'd order and motion of the Stars, ſo one of the ſeveral Uſes intended by the Author of Nature in them, may particularly reſpect Men; yet I am apt to think, that by what we hitherto know, 'twill not be eaſie to be prov'd, that ſome, at leaſt, of the Cœleſtial Bodies and Motions, may not be intended more for other purpoſes, than to caſt their Beams, or ſhed their Influences (ſuppoſing they have ſome) upon the Earth. And at leaſt, I cannot but think, that the Situations of the Cœleſtial Bodies, do not afford by far ſo clear and cogent Arguments, of the Wiſdom and Deſign of the Author of the World, as do the bodies of Animals and Plants. And for my part I am apt to think, there is more of admirable Contrivance in a *Mans Muſcles*, than in (what we yet know of) the *Celeſtial Orbs*; and that the Eye of a Fly is, (at leaſt as far as appears to us,) a more curious piece of Workmanſhip, than the Body of the Sun.

As for other *Inanimate* Bodies, as *Stones*, *Metals* &c, whoſe matter ſeems not organiz'd; tho' there be no abſurdity to think, that they alſo were made for diſtinct particular purpoſes, if not alſo for Human Uſes; yet moſt of them are of ſuch eaſy and unelaborate contextures, that it ſeems not abſurd to think, that various occurſions and juſtlings of the parts of the Univerſal matter, may at one time or other have *produc'd* them; ſince we ſee in ſome Chymical Sublimations, and Chriſtallizations of Mineral and Mettalline Solutions, and ſome other *Phænomena*, where the motions appear not to be Particularly guided and directed by an Intelligent Cauſe, that Bodies of as various Contextures, as thoſe are wont to be, may be produc'd;

duc'd ; of which I have elſewhere given ſome Inſtances.

If it be objected, that if we allow Chance, or any thing elſe, without the particular Guidance of a wiſe and All-diſpoſing Cauſe, to make a finely ſhap'd Stone, or a metalline ſubſtance, growing, as I have ſome times ſeen *ſilver* to do, in the form of a Plant ; it ought not to be denyed, that Chance may alſo make Vegetables and Animals : I can by no means allow the conſequence. There are ſome effects, that are ſo eaſy, and ſo ready, to be produc'd, that they do not infer any knowledge or intention in their Cauſes ; but there are others, that require ſuch a number and concourſe of conſpiring Cauſes, and ſuch a continued *ſeries* of motions or operations, that 'tis utterly improbable, they ſhould be produced without the ſuperintendency of a Rational Agent, Wiſe and Powerfull enough to range and diſpoſe the ſeveral intervening Agent's and Inſtruments, after the manner requiſite to the production of ſuch a remote effect. And therefore it will not follow, that if Chance could produce a ſlight contexture in a few parts of matter; we may ſafely conclude it able to produce ſo exquiſit and admirable a Contrivance, as that of the Body of an Animal. What then, if ſometimes in ſawing pieces of variegated Marble, men happen, tho' rarely, to meet with the Delineations or Pictures (ſome of which I have beheld with pleaſure) of Towns, Woods, and Men? For, beſides that the pleaſingneſs and rarity of ſuch ſpectacles inclines the Imagination to favour them, and ſupply their defects; would any wiſe man therefore conclude, that a real Town or wood, much leſs numbers of men, ſhould be made by ſuch a forluitons concourſe of matter? What compariſon is there, betwixt the workmanſhip that ſeems to be expreſſed in a few irregular

regular Lines, drawn upon a plane *ſuperficies*, and perhaps two or three Colours luckily plac'd; and the great multitude of Nerves, Veins, Arteries, Ligaments, Tendons, Membranes, Bones Glandules, *&c.* that are required to the compleating of a human Body; of which *numerous* parts (for the Bones alone are reckon'd to amount to three hundred) *every one* muſt have it's determinate ſize, figure, conſiſtence, ſituation, connexion, *&c.* and *many or all* of them together, muſt conſpire to ſuch and ſuch determinate Functions or uſes? And indeed, tho' I keep by me ſome curious ones, yet I never ſaw any Inanimate production of *Nature*, or, as they ſpeak, of *Chance*, whoſe contrivance was comparable to that of the meaneſt Limb of the diſpicableſt Animal: and there is incomparably more Art expreſs'd in the ſtructure of a Doggs foot, then in that of the famous Clock at *Strasburg*.

And, tho' the Paw of a Dog will be confeſs'd, to be of a ſtructure far Inferior to that of the Hand of a man: yet even This; however Ariſtotle prettily ſtyles it the *Inſtrument of Inſtruments*, is a leſs conſiderable Inſtance to my preſent purpoſe, than another Inſtance, which therefore, ſince my intended brevity permits me not to conſider *many*, I ſhall pitch upon, as that which I ſhall almoſt only inſiſt on, in the following part of this Tract. And this Inſtance is afforded me by the Eye. For Tho' the parts that concurr to make up that admirable Organ of viſion, are very numerous, yet how little any of them could have been ſpar'd or alter'd, unleſs for the worſe, may appear by that great Number of Diſeaſes, that have been obſerv'd in that little part of the Body. Since each of thoſe Diſeaſes conſiſt in this, that ſome of the Coats, Humors, or other parts of the Eye, is brought into a State differing from that whereto

Nature had deſign'd it, and whereinto ſhe had put it. 'Twould be tedious ſo much as to enumerate the ſeveral diſtempers of the Eye, whereunto Phyſitians have given particular Names; wherefore I ſhall only mention two or three things, wherein one would ſcarce imagine, that a ſmall receſs from the natural ſtate could bring any *conſiderable*, or perhaps *ſenſible*, inconvenience. That which we call the *Pupil*, is not (you know) a ſubſtantial part of the Eye, but only a hole of the *Uvea*: which aperture is almoſt perpetually changing it's bigneſs, according to the differing degrees of Light, that the Eye chances from time to time to be expos'd to. And therefore one would not think, but that, whilſt this hole remains open, it performs well enough it's part; which is, to give admiſſion to the Incident beams of Light, whether direct or reflected. And yet I lately ſaw and diſcours'd with a woman, who after a Feaver, was not able to debate the Pupils of her eyes as formerly; and tho' they were ſo very little narrower then ordinary, that I ſhould ſcarce have taken more notice that 'twas at all ſo, if ſhe had not told me of it, yet ſhe complain'd ſhe had thereby almoſt loſt her ſight, ſeeing Objects in certain Lights but very dimly and imperfectly. And tho' the Præternatural conſtriction of the Pupil be not a frequent diſtemper, yet tis not ſo rare, but that Phyſitians have given it a place among the Stated diſeaſes of the eye. And on the other ſide tho' it appear by what hath been newly related, that a competent wideneſs of the Pupil is requiſite to clear and diſtinct Viſion, yet if it's wideneſs exceed due Limits, there is produced that diſtemper that is call'd *Dilatatio pupillæ*; which is worſe then the former, becauſe it oftentimes deprives the Patient almoſt totally of his ſight. And, *tho'* it may ſeem but a ſlight circumſtance, that the tranſparent coats of the eye ſhould be devoid of colour, and of as little moment, that the *cornea* ſhould be very ſmooth, provided it be tranſparent: yet when either of theſe circumſtances is wanting, the ſight may be much vitiated; as we ſee that in the Yellow-Jaundies, when 'tis come to a high degree, the adventitious Tincture wherewith the Eye is Imbued, makes men think they ſee a yellowneſs in many objects, to which that colour does not belong. And I know an Ingenious Gentleman, who, having had a ſmall *puſtula* excited and broken upon the *Cornea*, tho' the eye have been long whole; yet a very little Inequality or depreſſion that ſtill remains upon the Surface of the Tranſparent *Cornea*, does ſo affect him, that tho' he can read well in a Room, yet when he comes into the open fields or the ſtreets, he for a pretty while (as himſelf has particularly complain'd to me) thinks many of the Objects he looks on very Glareing, and ſees many others, as men do ſtones at the bottom of a Brook or running water; which I impute to the want of Uniformity in the refraction of thoſe reflected beams of Light, that fall upon the *Cornea*, whoſe ſurface is not ſo ſmooth and equal as it ſhould be.

To give ſome further Proof, that the Eye was made with deſign, I ſhall here take notice of an obſervation or two, that do not occurr in the diſſection of a human Eye, and therefore are not wont to be mentioned by Anatomiſts.

I have obſerved in Frogs, (as I preſume ſome others alſo may have done) that, beſides thoſe parts of the Eye which they have in common with Men, Dogs, Cats, and the moſt part of other Animals, They have a peculiar, whether membrane, or Cartilage, or both, which ordinarily is not perceived; wherewith they can at pleaſure cover the Eye, without too much hindering the ſight, becauſe this membrane is as well Tranſparent as ſtrong; ſo that it may paſs for a kind of moveable *Cornea*, and (if I may ſo call it) a kind of falſe-ſcabord to to the Eye. In furniſhing frogs with this ſtrong Membrane, the providence of Nature ſeems to be conſpicuous: For they being Amphibious Animals, deſign'd to paſs their lives in watery places, which for the moſt part abound with Sedges, and other plants endowed with ſharp Edges or points; and the progreſſive motion of this Animal being to be made, not by *walking*,but by *leaping*; if his Eyes were not provided of ſuch a ſheath as I have been mentioning, he muſt either ſhut his Eyes, and ſo leap *blindly*, and by conſequence *dangerouſly*, or, by leaving them open, muſt run a venture to have the *Corneæ* cut, prickt, or otherwiſe offended, by the edges or points of the Plants, or what may fall from them upon the Animals Eye: whereas this Membrane, as was ſaid, is like a kind of Spectacle that covers the Eye without taking away the ſight; and as ſoon as the need of imploying it is paſt, the Animal at pleaſure withdraws it into a little Cell, where it Reſts out of the way, till there be occaſion to uſe it again. This you may ſee, if you apply the point of a pin, or a Pen, or any ſuch ſharp thing, to the Eye of a frog, whilſt you hold his head ſteady: for to ſcreen his Eye, he will preſently cover it (at leaſt for the greateſt part) with this Membrane, which when the danger is over he will again withdraw. And, becauſe many if not moſt ſorts of Birds, are wont or deſtinated to fly, (as more would do if not kept tame) among the Branches of Trees and Buſhes; leaſt the Prickles, Twigs, Leaves, or other parts ſhould wound or offend their Eye. Nature hath given them likewiſe ſuch another kind of horny Membrane, as we have been mentioning in frogs.

'Tis known that Men, and the generality of Four-footed Beaſts, and of Birds, have ſeveral Muſcles belonging to their Eyes; by the help of which Muſcles, they can turn them this way, or that way, at pleaſure; and ſo can obvert the Organ of Senſe to the Object, whether it be placed on the right hand or the left, or above or beneath the Eye. But, Nature having not given that Mobility to the Eyes of Flys, (the reaſon whereof I ſhall not now ſtay to conſider) ſhe hath in recompence furniſh'd them with a multitude of little *protuberant* parts, finely rang'd upon the convex of their large and Protuberant Eyes: So that by means of the number of theſe little Studs (if I may ſo call them) many beams of Light that rebound from Objects placed on either hand, or above, or beneath, the level of the Eye, fall conveniently enough upon that Organ, to make the Objects they come from, viſible to the Animal.

Which you will the more eaſily believe, if you contemplate (as I have often done with great pleaſure) even the Eye of an ordinary Fleſh-Fly, (for Bees and other greater Inſects have immoveable Eyes too, but I find them not ſo pretty) in a good Microſcope and a clear Day. For you may reckon ſome hundreds of theſe little round Protuberances, curiouſly rang'd on the Convexity of a ſingle Eye.

But perhaps ſome, whoſe partiality for *Chance* makes them willing to aſcribe the ſtructures of Animals rather to That, then to a deſigning Cauſe; will make them draw an Objection, fit to be here obviated, againſt our Doctrine, from what we have obſerv'd of the difference between Human and other Eyes: Since they will pretend that all Organs of Sight ought to be conform'd to thoſe of Men, as thoſe that are the beſt and moſt perfect. 'Tis true, that Man being juſtly reputed the moſt perfect of Animals, it is not ſtrange that he ſhould (as Men generally do) preſume, that His Eyes and other parts of his Body, are the beſt contriv'd of any that are to be found in Nature. But yet I think we cannot from hence ſafely conclude, that all Eyes, which in other Animals are of Structures differing from thoſe of Man, are for that reaſon defective. For I conſider, *Firſt*, That the admirable Wiſdom diſplay'd by the Author of Things, in fitting the Eyes and other Organical parts of Animals, for the Uſes that ſeem manifeſtly to have been deſign'd in their Fabrick, and for the reſpective Functions we actually ſee them exerciſe, may juſtly perſuade us, that the things whoſe Reaſons or Uſes we do not alike diſcern, are yet moſt wiſely conſtituted: Such an Author as God, having too much knowledge to do any thing unskilfully; and We having too much preſumption, if we think He can have in the framing of his Creatures, no Ends that are beyond our Diſcovery. And, *Secondly*, We may repreſent, that the Eye is not to be conſider'd abſtractedly as an Inſtrument of Viſion, but as an Inſtrument belonging to an Animal of this or that kind; and who is ordinarily to make uſe of it in ſuch and ſuch Circumſtances. And therefore I think it ought not at all to Diſparage, but rather highly Recommend, the Wiſdom and Providence of the great Author of Things; that he has furniſh'd various Species of Animals, with Organs of Sight that are very differingly fram'd and plac'd: Since this diverſity nobly manifeſts his great Providence, and (if I may ſo call it) Forecaſt; that has admirably ſuited the Eyes of the differing kinds of Animals, both to the reſt of their Bodies, and (which I here mainly conſider) to thoſe parts of the great Theatre of the World, on which He deſigns that they ſhall live and act. Thus though divers Beaſts, as Horſes, Oxen, and ſome others, have their Eyes furniſh'd with a ſeventh Muſcle, beſides the ſix they have in common with Men; we muſt not conclude, either that the Organs of Viſion are Imperfect in Men, or that thoſe of theſe Beaſts have ſomething ſuperfluous. For Horſes,*&c.* being to feed for the moſt part on graſs and herbs of the Field, and, that they may the better chuſe their Food, being oblig'd to make their Eyes look very long downwards; the ſeventh Muſcle does excellently ſerve them to do ſo, without that wearineſs, which if they were not furniſh'd with it, that durably conſtrain'd Paſture would be ſure to give them; whereas Man who has no ſuch neceſſity of looking aſſiduouſly downwards, would be but incumber'd by a ſeventh Muſcle.

On the other ſide, the defectiveneſs obſervable in the Eyes of ſome Animals, in compariſon of thoſe of Man, may be aſcrib'd to the thriftineſs (if I may ſo ſpeak) of *Nature*, that, on moſt occaſions, declines doing that which is not neceſſary to the particular Ends, She aims at in the Fabrick of a Part. Thus *Moles* being deſign'd to live for the moſt part under Ground, the Eyes which Nature hath given them, are ſo little, in proportion to their Bodies, that 'tis commonly believ'd, and even by ſome Learned Men maintain'd, they have none at all. But tho' by Anatomy, I, as well as ſome others that have try'd, have found the Contrary; yet their Eyes are very differing from thoſe of other Four-footed Beaſts. Which is not to be wonder'd at; conſidering, that the deſign of Nature was, that *Moles* ſhould live under Ground, where a Sight was needleſs and uſeleſs; and where greater Eyes would be more expos'd to danger: And their Sight, as dim as 'tis, is ſufficient to make them perceive that they are no longer under Ground, (at leaſt ſo as they are wont to be) which ſeems to be the moſt neceſſary uſe they have of Light and Eyes.

Zoographers obſerve, That the *Camelion* has avery uncommon ſtructure of his viſive Organs; ſince, to omit leſſer, tho' not inconſiderable, peculiarities, his Eyes often move independantly from one another; ſo that, for Inſtance, he may look directly forward with the right Eye, and with the other at the ſame time, directly backwards towards his Tail; or may turn the Pupil of the former ſtraight upwards, whilſt he looks downwards with the other. Which peculiar power ſeems to have been granted him by Providence, that, being a very low Animal, and deſtinated to live for the moſt part in Trees and Buſhes, and there chiefly feed on Flys ; He may perceive them, which way ſoever they chance to come within the reach of his long Tongue, by ſuddenly darting out of which, he catches his nimble Prey.

Whereas it may be obſerv'd, that many or moſt, if not all, meer Fiſhes have the Chryſtalline Humours of their Eyes, almoſt ſpherical as to Senſe, and conſequently far more round than that Humour is wont to be found in Man, and other Terreſtrial Animals. This difference of Figure, tho' it would be inconvenient in Us, does very well accommodate Fiſhes ; ſince they living in the Water, which as a thicker *Medium*, does much more refract the Beams of Light, than the Air through which they paſs to our Eyes ; 'twas fit, that the Chryſtalline Humour of Fiſhes ſhould be very Globous, that by the help of their Figure, the Beams already refracted by the Water, ſhould be yet ſo much refracted and made Convergent, as to Paint the Images ſo near, as upon the bottom of the Eye.

One that being Curious, had more Opportunity than I have, to ſurvey and reflect on the various Structures of the Organs of Viſion in differing Animals, may, if I miſtake not, be able to find by comparing them with the other parts of the ſame Animal, and the Scene he is deſign'd to act on, and the uſes he is to make of his Eyes in his moſt ordinary Circumſtances; ſuch a Perſon, I ſay, may be able to offer a probable Reaſon of ſeveral differences in thoſe Organs, that, if commonly taken notice of, would ſeem to the Cenſorious to be aberrations of Nature, or defects: To which purpoſe I remember, that an ingenious Cultivator of Opticks, gives this Reaſon, of what both he and I, have taken notice of (tho' it be uſually overlook'd) about the Figure of the Pupil; namely, that, tho' it be oblong in Horſes, Oxen, and divers other Quadrupeds, as well as in Cats, yet in the former kinds of Animals, the Pupil lies tranſverſly from the right ſide of the Eye to the left, but in Cats its ſituation is perpendicular; whereof he ingeniouſly gueſſes the Reaſon may be, that Horſes and Oxen, being uſually to find their Food growing on the Ground, they can more conveniently receive the Images of the laterally neighbouring Graſs, *&c.* by having their Pupils tranſverſly plac'd; whereas Cats, being to live chiefly upon Rats and Mice, which are *Animals* that *uſually* climb up or run down Walls, and other ſteep Places; the commodiouſeſt ſituation of their Pupil for readily diſcovering and following theſe Objects, was to be Perpendicular. But 'tis time we proceed in our Diſcourſe.

Other Inſtances to the ſame purpoſe with this are elſewhere deliver'd: and therefore I ſhall now, to ſtrengthen the Apology for Divine providence, take notice, that the differing ſtructures and Situations of the Eyes in ſeveral Animals, are very fit to ſhew the fœcundity of the Divine Authors Skill, (if I may ſo ſpeak,) in being able to frame ſo great a Variety of exquiſite Inſtruments of Viſion. And indeed, if I may preſume to gueſs at any of Gods Ends that are not manifeſt, (for ſome others of his Ends ſeem Conſpicuous;) I ſhould think, that this delightful and wonderful Variety that we may obſerve, not only in Animals themſelves conſider'd as entire Syſtemes, but in thoſe parts of them that appear deſtinated for the ſame Function, as particularly that of Seeing, was deſign'd, at leaſt among other Ends, to diſplay the multiplicity of the great Creators Wiſdom, and Shew his intelligent Creatures, that his Skill is not confin'd to one ſort of Living Engines; nor in the parts of the ſame kind, (as Eyes, Ears, Teeth, *&c.*) to the ſame Contrivances : but is able to make for the ſame uſe, a multitude of ſurpriſing Organs or Inſtruments, tho' not perhaps all equally Perfect, (ſince to do ſo, we may think he muſt make no Animals but Men,) yet all of them curious and exquiſite in their kinds, and in order to their differing Ends. To be able to frame both Clocks, and Watches, and Ships, and Rockets, and Granadoes, and Pumps, and Mills, *&c.* argues and manifeſts a far greater Skill in an Artificer, than he could diſplay in making but one of thoſe ſorts of Engines, how artificially ſoever he contriv'd it. And the ſame ſuperiority of knowledge would be diſplay'd, by contriving Engines of the ſame kind, or for the ſame purpoſes after very differing manners. As Weights indeed are of great uſe and neceſſity in the famous Clock of *Straſburg* ; and therefore it recommends the Inventors of Watches, not only that they can make Clocks of a very little and eaſily portable Bulk, which the *Straſburg* Machine is not, but can make a Clock without weights, and by means of a Spring perform their Office. And thus, tho' to fly, it ſeems abſolutely neceſſary that an Animal ſhould be furniſht with Feathers; the Wiſe Creator hath ſhewn that he is not confin'd to make uſe of them for that purpoſe: ſince a Flying Fiſh is able to move a great way in the Air; and the Indies have lately furniſht us with a ſort of flying Squirrils (whereof I ſaw one alive at *White-Hall.*) And tho' the flight of theſe is not long, yet there is another kind of Animals without Feathers that can fly long enough, namely the Batt; tho' ſome of theſe, as I have ſeen, be little leſs then Hens: and I have been aſſurd by a credible Eye-witneſs, that in the kingdom of *Golconda*, He had ſeen much bigger.

But *tho'* this conſideration may ſuffice to juſtify the Wiſdom of the Creator, who being an Agent moſt Free, as well as moſt Wiſe; Men ought not to find fault, if he think fit to Recommend his Wiſdom by diſplaying it in very different manners: *yet* this is not all that may be ſaid on this occaſion. For there are many Caſes, and perhaps far more than we imagine, wherein the peculiar, and in ſome regards leſs perfect, fabrick or ſituation of an Eye or other Organical part, may be more convenient than the correſpondent Organ of Man, to attain the Ends for which was given to an Animal that was to act upon ſuch a Theatre, and live by ſuch Proviſion. Beſides that an Organical part may, in ſome Animals, be intended for more uſes than in others, and therefore may require a differing ſtructure; as in Moles, the Feet are otherwiſe fram'd or ſituated than in other Quadrupeds; becauſe the chief uſe they were to make of them was to walk upon the Ground, but to Dig themſelves ways Under Ground. The provident δημιουργὸς wiſely ſuiting the Fabrick of the Parts, to the Uſes that were to be made of them: as a mechaniſt imploys another Contrivance of his Wheels, Pinions, *&c.* when he is to grind corn with a Mill that is to be driven by Water, than when he is to do the ſame thing by a Mill that is to be mov'd by the Wind. And the Camelion has a Tongue, both pecurliarly ſhap'd, and of a length diſproportionate to that of his Body, becauſe he was to take his Prey, by ſhooting out (if I may ſo ſpeak) his Tongue at the Flies he was to live upon, and could not often approach them very near without frighting them away. And in many Caſes in which this Reflection does not ſo properly take place, we may obſerve, that there is a wonderful Compenſation made, for that which ſeems a defect in the parts of an Animal of this or that particular *ſpecies,*

cies, compar'd with the correſpondent ones of a Man, or an Animal of ſome other *ſpecies*.

Thus Birds, that (except the Bat and one or two more) want Teeth to chew their food,are not only furniſh'd with hard Bills to break it ; and Birds of prey, as Hawks, *&c.* with crooked ones to tear it ; but, which is more conſiderable, have Crops to prepare and ſoften it, and very ſtrong Muſcular Stomachs to digeſt and grind it : In which work they are uſually help'd by gravel and little ſtones that they are led by Inſtinct to ſwallow, and which are often found (and ſometimes in amazing numbers,)in their Stomachs where they may prove a vicarious kind of Teeth.

I ſhall hereafter have occaſion to ſay ſomewhat more againſt Their Opinion, that find fault with thoſe Animated Structures that we think to be Productions of the Divine Wiſdom, under pretence that the

Parts of ſome living Creatures are not ſo curious and Symmetrical, as not to have been caſually producible. But in the mean time, I ſhall here note, for thoſe that aſcribe ſo much to *Chance*; that Chance is really no natural Cauſe or Agent, but a Creature of Man's Intellect. For the things that are done in the Corporeal World, are really done by the parts of the Univerſal Matter, acting and ſuffering according to the Laws of Motion, eſtabliſh'd by the Author of Nature. But we Men, looking upon ſome of theſe parts as directed in their Motions by God, or at leaſt by Nature, and diſpos'd to the attainment of certain Ends; if by the intervention of other Cauſes, that we are not aware of, an Effect be produc'd very differing from that which we ſuppos'd was intended; we ſay, that ſuch an Effect was produc'd by Chance. So that *Chance* is indeed but a Notion of *Ours*, and ſuch a thing as a School-man might call an *Extrinſecal Denomination*, and ſignifies but this; that *in our apprehenſions*, the Phyſical Cauſes of an Effect, did not Intend the Production of what they nevertheleſs produc'd. And therefore I wonder not, that the Philoſophers that preceded *Ariſtotle*, ſhould not treat of Chance, among Natural Cauſes; As we may learn from *Ariſtotle* himſelf; who is more juſt to Them in Suſpecting they own'd not ſuch a Cauſe, than in Taxing them of an Omiſſion for not having Treated of it.

And on this occaſion, I ſhall only add, before I proceed, that whereas ſome of the moſt curiouſly ſhap'd kind of Stones, as the *Aſtroites*, have embolden'd many of the Favourers of *Epicurus*, to bring them into Competition with theſe Animals, or Parts of Animals, from their likeneſs to which, they have receiv'd their Names; it is fit to be conſider'd, *Firſt*, that ſome Learned Men have of late made it very probable, that ſome of the curiouſeſt ſorts of theſe Stones were once really the Animals whoſe ſhapes they bear, or thoſe Parts of Animals which they reſemble; which Animal ſubſtances were afterwards turned into Stones, by the ſupervening of ſome Petreſcent Matter, or Petrifying Cauſe; of which *Metamorphoſis* I have met with, and do elſewhere mention, more Inſtances than are fit to be ſo much as named in this place. *Secondly*, *Though* ſome of thoſe ſorts of Stones were the Production of the Mineral Kingdom; (for I will not be Dogmatical in this Point) *yet*, beſides that it would not clearly follow, that they owe their ſhapes to Chance, ſince there is no abſurdity to admit *Seminal* Principles in *ſome* more *elaborate* ſorts of Foſſiles; I think it would be very injurious to make theſe Productions vye with the Animals, to which they are Compared.

For the Reſemblance of ſhapes, wherein alone they and the Animals Agree, being but the Outward Figure, is but a Superficial thing, and not worthy to be mention'd, in compariſon of that wherein they differ: The rude and ſlight Contexture of the beſt ſhap'd Stones, being incomparably inferior to the Internal contrivance of an Animal; which muſt conſiſt of a multitude of Parts, of ſuch a Figure, Bulk, Texture, Situation, *&c.* as cannot but be obvious to any that have ſeen Diſſections skilfully made. And 'tis not only in the Stable and Quieſcent parts, that this great Internal Difference between Stones, and the Animals they reſemble, is to be found; but there is in a Living Animal a greater difference, than any of the Knives of Anatomiſts can ſhew us in a Dead one betwixt a Stone, tho' never ſo curiouſly Figur'd, and an Animal. For there are, I know not how many, Liquors, Spirits, Digeſtions, Secretions, Coagulations,

tions, and Motions of the whole Body, and of the Limbs and other parts, which are lodged and perform'd in a Living Body, and not in a *Cadaver*; and are perchance far more admirable, even than the ſtructure of the ſtable and quieſcent Parts themſelves. So that, tho' a Stone, outwardly very like a Shell-fiſh, were made by Chance; yet from thence to Conclude, that Chance may make a real Living Shell-fiſh, would be to argue worſe than he that ſhould contend, that, becauſe even an unskilful Smith may make a hollow piece of Metal, like a Watch Caſe, tho' he can fill it but with filings of Iron, or ſome other rude Stuff, he muſt be able to make a Watch; there being leſs difference betwixt the skill expreſs'd in making the Caſe of a Watch, and the Movement, than in making a Body like a Shell, and the Internal parts of a real Fiſh: Or to ſay, that, becauſe Putrefaction and Winds, have ſometimes made Trees hollow, and blown them down into the Water, where they ſwim like Boats, therefore the like Cauſes may make a Galley built andcontriv'd, as well withinas without, according to the Laws of Naval Architecture, and furniſh'd with Mariners to Row it, Steer it, and, in a word, to excite and guide all its Motions to the beſt Advantage, for the Preſervation and various Uſes of the Veſſel. In ſhort, if *Chance* ſometimes does ſome ſtrange things, 'tis in reference to what *She her ſelf*, but not to what *Nature*, uſes to perform.

And now, to give you the Summary of my Thoughts, about the *Second* Queſtion ; 1. I think, that from the Ends and Uſes of the Parts of *Living* Bodies, the Naturaliſt may draw Arguments, provided he do it with due Cautions, of which I ſhall ſpeak under the fourth Queſtion. 2. That the *Inanimate* Bodies here below, that proceed not from Seminal-Principles, have but a more parable Texture, (if I may ſo ſpeak) as Earths, Liquors, Flints, Pebbles, and will not eaſily warrant Ratiocinations, drawn from their ſuppoſed Ends. 3. I think, the Cœleſtial Bodies do abundantly declare God's Power and Greatneſs, by the Immenſity of their Bulk, and (if the Earth ſtand ſtill) the Celerity of their Motions, and alſo argue his Wiſdom and general Providence as to them; becauſe He has for ſo many Ages, kept ſo many vaſt *Vortices*, or other Maſſes of Matter, in ſcarce conceivably rapid Motions, without deſtroying one another, or looſing their Regularity. And I ſee no Abſurdity in ſuppoſing, that, among other Uſes of the Sun, and of the Stars, the Service of Man might be intended; but yet I doubt, whether, from the bare Contemplation of the Heavens and their Motions, it may be cogently inferr'd, at leaſt ſo ſtrongly as Final Cauſes, may be from the ſtructure of Animals, that either the ſole, or the chief, End of them all, is to enlighten the Earth, and bring Benefits to the Creatures that live upon it.

In what has been hitherto ſaid on our *Second* Queſtion, 'tis plain, that I ſuppoſe the Naturaliſt to diſcourſe meerly upon Phyſical Grounds. But if the Revelations, contain'd in the *Holy Scriptures*, be admitted, we may rationally believe More, and ſpeak leſs Hæſitantly, of the Ends of God, than bare Philoſophy will warrant us to do. For, if God is pleaſed to declare to us any thing concerning His Intentions, in the making of his Creatures, we ought to believe it; tho' the Conſideration of the things themſelves, did not give us the leaſt ſuſpicion of it; which yet in our caſe they do. And therefore a late Ingenious Author did cauſleſsly reflect upon me, for having mention'd the Enlightning of the Earth, and the Service of Men, among the Ends of God, which he thought undiſcoverable by us. For whether or no we can diſcover them by meer Reaſon, as divers of the Heathen Philoſophers thought they did; yet ſure we may know Thoſe that God is pleas'd to Reveal to us: And the Perſons, I argu'd with, were apparently ſuch as admitted the Authority of the Scriptures; which expreſly teach us, that God made *the two* Gen.1.16. *great Luminaries*, (for ſo I ſhould render the *Hebrew* words את־שני המארת הגדלים) *the greater for the rule of the Day, and the leſſer for the rule of the Night.* And that *He made the Stars alſo*, and ſet them in the Firmament, or rather *Expanſum* of the Heaven, *to give Light upon the Earth.* And a little above, among the Uſes of the Luminaries theſe are reckon'd, *to divide the Day* ver. 14.

from the Night, and to be for Signs, and for Seaſons, and for Days and Years. And in another place, the Prophet *Moſes* dehorting the Iſraelites from Worſhiping the Sun, the Moon, and the Stars, tells them, that the *Lord, had imparted them unto all nations under the whole Heaven.* Deut. 4. 19. And therefore thoſe *Carteſians*, that being Divines, Admit the Authority of Holy Scripture; ſhould not reject the Conſideration of ſuch Final Cauſes, as *Revelation* diſcovers to us; ſince 'tis certainly no preſumption to think we know Gods Ends, when he himſelf acquaints us with them; nor to beleive that the Sun, tho' it be generally eſteem'd to be a nobler Body than the Terreſtrial Globe, was made, among other Purpoſes, to give Light to its Inhabitants. 'Tis recorded in the Book of *Geneſis*, the Deſign of God in making man, Gen. 1. 26, 27, 28. was, that *men* ſhould *Subdue the Earth*

Earth (as vaſt a Globe as 'tis) *and have dominion over the Fiſh of the Sea, and over the Fowle of the Air, and over the Cattle, and over all the Earth*, and (to ſpeak Summarily) *over every living thing that moveth upon the Earth*. And Gen 9.23. the ſame Book informs us, that after the Deluge, God *deliver'd all Terreſtrial Beaſts, and Fowle, and Fiſhes, and every moving thing that lives*, into the hands of Men; and intended that they ſhould eat Animals, as before the Gen. 1.29. Flood, He had appointed them all the ſorts of wholſome Vegetables for their Food. And ſince God was pleaſed to appoint that men ſhould live on theſe Creatures, it cannot be abſurd to ſay, that, among other Purpoſes to which he deſtinated the Sun, His Shining upon the Earth was one; ſince without His Light and Heat, men could not provide for, or enjoy themſelves; and neither thoſe Plants that Men and Cattel muſt live upon, could grow and ripen; nor (conſequently) thoſe Animals that were to be their principal Food, and ſerve them for many other uſes, could be ſuſtain'd and provided for. Many other Texts that ſhow, how much God was pleas'd to intend mans welfare, and Dominion over many of his Fellow-creatures, might be here alledg'd. But I ſhall content my ſelf to mention, what the Kingly Prophet ſayes in the 8*th* Pſalm, where ſpeaking of Man to his Maker, he ſayes; *Pſal.* 8. 5 6. *Thou haſt made him, a little lower than the Angels, and haſt crown'd him with Glory and Honour. Thou mad'ſt him to have dominion over the works of thine hands, and haſt put all things under his Feet.* Indeed if in Man we conſider only that Viſible Part, his Body; the ſmallneſs of it may make it thought improbable, that Portions of the Univerſe incomparably greater than He, ſhould be at all intended to be ſerviceable to Him. But Chriſtians ought not to think this incredible,

dible, if they conſider Man, as he chiefly conſiſts of a Rational Mind; which proceeds immediately from God; and is capable of knowing him, loving him, and being Eternally happy with him. They that deſpiſe Man conſider'd in this capacity, do very little know the worth of a Rational Soul; and eſtimate things like Maſons, and not like Jewellers, who juſtly value a Diamond no bigger than a Bean, more than a whole Quarry of ordinary Stones. And particularly to thoſe Undervaluers of their own *Species* that are Divines; it may be repreſented, that God, who will not be deny'd to be the beſt Judge in this caſe, as in all others; was pleas'd to conſider Men ſo much, as to give David cauſe to admire it in the words lately cited; and not only to endow them with his Image at their firſt Creation, but when they had criminally loſt and forfeited it, he vouchſaf'd to Redeem them by no leſs than the Sufferings and Death of his own Son; who is incomparably more excellent than the whole World. And 'tis not incredible that God ſhould have intended, that many of his other works ſhould be ſerviceable to Man; ſince by Miraculous Operations he hath ſometimes Suſpended the Laws of Nature, and ſometimes Over rul'd them, upon the account of Man: as may appear *by Noahs* Flood; *by* the paſſage of the *Iſraelites* on dry Land through the Red Sea, and the River of *Jordan*; *by* the ſtanding ſtill of the Sun and Moon (or the Tereſtrial Globe) at *Joſhua's* command; *by* the in efficacy of the burning Fiery Furnace, on *Daniels* three Companions; and (to be ſhort) *by* the ſtupendious Ecclipſe of the Sun at the full Moon, at the Crucifixion of the *Meſſias*. To which I might add, that the chief part of Mankind, namely the Children of God, will by their moſt bountiful Remunerator, be thought fit to inhabit the *New World* (for that by an Hebraiſm is meant by the *new Heavens and the new Earth*

St. *Peter* ſpeaks of) which ſhall ſucceed the Renovation and Refinement of the Preſent World by the laſt Fire, that will not only Diſſolve, but, if I may ſo ſo ſpeak, Transfigure it.

2 *Pet.* 3. 10, 11, 12, 13.

And we ſhall the leſs ſcruple to admit that ſuch vaſt and bright Bodies as the Sun and Moon, may be deſign'd (among other things) to be ſerviceable to Men ; if we conſider, that 'tis ſo far from being a conſtant Rule, That a Thing more excellent cannot (by a wiſe Agent) be imploy'd for the good of one that is leſs ſo ; that not only the firſt Angel whoſe Apparition we read of in the Scripture, was ſent to relieve *Hagar*, a Slave wandring in a Wilderneſs ; another had regard to the life of a Sooth-ſayers Aſſe ; and many others (and ſometimes Companies of them) were imployd on Earth to do good Offi-

Gen. 16. 9. &c.

Numb. 22. 23.
Gen. 32. 1, 2.
2 *Kings* 6. 17.

ces to particular perſons : but of all the Angels in general ; the Excellent Epiſtle ~~to~~ to the Hebrews informs us, That
Heb. 1. 14. they *are Miniſtring Spirits, ſent forth to Miniſter unto them who ſhall be Heirs of Salvation.*

SECT. III.

To handle the *Third* Queſtion, † It will be neceſſary for us to clear the grand Difficulty that has, ever ſince *Ariſtotles* time, and even before that, Perplex'd thoſe that allow in Natural ral Philoſophy, the Conſideration of *Final Cauſes*. The Difficulty is obvious enough: For, much the greater part of Bodies being void of Knowledge, and moſt of them (as all *Inanimate* Bodies) of Life it ſelf, it ſeems not conceivable, how they ſhould act conſtantly for Ends, they are not capable of predeſigning; and appoſitely imploy Means

† viz. *Whether, and in what ſenſe, the Acting for Ends may be aſcribed to an Unintelligent, and even Inanimate Body?*

that they have no Knowledge wherewith to make choice of.

Ariſtotle, who expreſly teaches, that Nature does nothing in vain, and rightly judg'd, that the Actions of Natural Agents tended to certain Ends, takes notice of this Difficulty; but ſeems rather to Shift it off than Reſolve it; The Solution he frames regarding ſo peculiarly the Words wherein he has expreſs'd the Objection, that I much doubt, whether it would ſignifie much to clear the ſame Difficulty propos'd in other Terms. And to me he ſeems to ſpeak ſo darkly, not only in his Tranſlators *Latine*, but in his own *Greek*, that, if he have given a good Solution of the Difficulty, I muſt ingenuouſly confeſs my Dullneſs, in not being able to underſtand it.

vid. Ariſtot. De Cœlo, *lib.* II. *c.*5. & eund. De Gen. & Interitu *lib.* II. *cap.* 10.

But, to conſider the Difficulty it ſelf, there are two Accounts, on which the Actions of natural Agents may be ſaid to tend to a certain End: *One*, when the Agent has a Knowledge of that End, and acts with an Intention to obtain it; as, when a man ſhoots an Arrow to hit a mark: The *Other* is, when the Action of the Proximate Agent, is indeed ſo directed as it ought to be to obtain an End, and yet that End is neither Known nor Intended by the Proximate Agent, but by a Remoter Agent that is Intelligent. In the *former* of theſe Senſes, I cannot admit that (not now to Examine whether any Living, but not Rational, Works of Nature May) any Inanimate Bodies Can, act for an End; for, to do ſo, preſuppoſes, that the Agent both Knows the End he is to attain, and Purpoſes to attain it; which are things whereof Inanimate Bodies are uncapable. And *to* fancy with ſome, that they may have a Knowledge *ſui generis* (as they ſpeak,) which, tho' confin'd to the actions proper to this or that particular kind of Body, is yet ſufficient to determine to thoſe Actions; is *to* offend againſt that rational and receiv'd Rule of Philoſophizing, *Entia non ſunt multiplicanda ſine neceſſitate*, and *to* introduce a ſort of Knowledge, which I fear the Propoſers do not well conceive; or at leaſt, I am ſure I do not.

It remains then, that I embrace the *ſecond* Senſe, in which we formerly ſaid, that Natural things may be ſaid to to work for an End; tho' indeed in this Caſe, we muſt ſpeak ſomewhat improperly: For, by him that Conſiders, the Action will be oftentimes more juſtly attributed to the Intelligent, but Remoter, than to the Immediate, Agent, which is but, as it were, the Inſtrument of the other. But how this is poſſible to done, appears difficult to be explain'd.

plain'd. To me it ſeems, it may be thus conceiv'd: The moſt Wiſe and Powerful Author of Nature, whoſe peircing ſight is able to penetrate the whole Univerſe, & ſurvey all the parts of it at once, did at the Beginning of Things, Frame things Corporeal into ſuch a Syſtem, and Settled among them ſuch Laws of Motion, as he judg'd ſutable to the Ends he propos'd to Himſelf, in making the World. And *as* by vertue of his vaſt and boundleſs Intellect that he at firſt imploy'd, he was able not only to See the Preſent State of things he had made, but to Foreſee all the Effects, that particular Bodies ſo and ſo qualify'd, and acting according to the Laws of Motion by him eſtabliſh'd, could in ſuch and ſuch circumſtances, have on one another: *So* by the ſame Omniſcient Power, he was able to contrive the whole Fabrick, and all the parts of it, in ſuch manner, that, whilſt his general Concourſe maintain'd the Order of Nature, each

Part of this great Engine, the *World*, ſhould without either Intention or Knowledge, as regularly and conſtantly Act towards the attainment of the reſpective Ends which he deſign'd them for, as if themſelves really underſtood, and induſtriouſly proſecuted, thoſe Ends. Juſt as in a well made Clock, the Spring, the Wheels, the Ballance, and the other parts, *tho'* each of them Act according to the Impulſes it receives, and the Determination that is given it, by the other pieces of the Engine, without knowing what the Neighbouring Parts, or what themſelves do; *yet* their Tendencies are ſo Determin'd, and ſometimes Overrul'd, and their Motions ſo Quickn'd, by the ſtructure of the Clock, that they would not move more conveniently, nor better perform the Functions of a Clock, if they *knew* that they were to make the *Index* truly mark the Hours, and *intended* to make it do ſo. 'Tis true, that 'tis not eaſie to conceive how One

Agent ſhould, by ſo ſimplean Inſtrument as *Local motion*, be able to Direct a Multitude of Agents, as numerous as the Bodies that make up a World, to Act as regularly, as if each of them Acted upon its own particular Deſign, and yet all of them Conſpir'd to obey the Laws of Nature. But if we conſider, that 'tis to God, that is an Omniſcient and Almighty Agent, that this Great Work is aſcrib'd, we ſhall not think it incredible; eſpecially if we conſider, that, whereas 'tis manifeſt enough, that a Multitude of Bodies Act, as we have ſuppos'd; if we will not aſcribe the Direction and Superintendence of the Motions, that are manifeſtly fitted for the attainment of Ends, unto God, we muſt do it to Nature; which will not Leſſen but Increaſe the Difficulty: And when I have ſeen, as ſometimes I have with pleaſure, a great Engine, wherein the Works of I know not how many Trades, and a great many other Motions, were perform-ed by little Puppets, that manag'd the Tools of the Artifficers ; and all theſe were ſet a work by one Spring, which communicated Motions that were regulated and determined by the particular ſtructure of the little Statues and other Bodies : when, I ſay, I conſider ſuch things as theſe, I cannot think it impoſſible that the Divine and Great Δημιουργὸς, as both Philoſophers and ſacred Writers have ſtyl'd the Worlds Creator ; ſhould be able by the Motions and Structures of Matter, to ſet a work very many Partial and Subordinate Engines. For 'twill not, I hope, be deny'd, that the Multitude of Theſe does not any thing near ſo much ſurpaſs the number of Thoſe, which I ſaw in the hand of an illiterate Tradeſman, as the Narrow Knowledge of that Artifficer is ſurpaſs'd by the Boundleſs Underſtanding of an Omniſcient Artiſt. And 'tis *more*, in the making ſo many and ſo various Bodys act according to their par-

Heb. 11. 10.

particular Deſignations,& yet all of them Conſpire to the General Ends of the Univerſe,that Gods Wiſdom, and (if I may ſo ſpeak) his Skill is diſplay'd, *than* barely in the making Bodies Act Appoſitely for Ends to themſelves Unknown. For, if Moving Bodies be duly diſplay'd, and have a ſufficient connection, 'tis not difficult to Direct a few of them to the attainment of an End propos'd by an Underſtanding Agent,tho' Unknown to the Immediate Agents: As anciently among the Jewiſh Husband-men, (and at this day in ſome parts of the Eaſt) the Ox, that intended no ſuch matter, did by Treading the Corn as well Separate the Grain from the Straw, as our Plowmen do, when they threſh it purpoſely to make that Separation: And a Horſe or an Aſs in a Mill, may as well by his going round Grind the Corn,as the Miller himſelf could do.

Nor is this Doctrine inconſiſtent with the beleif of any True *Miracle*; for, it ſuppoſes the Ordinary and Settled Courſe of Nature to be maintain'd, without at all denying, that the moſt Free and Powerful Author of Nature is able, whenever he thinks fit, to Suſpend, Alter, or Contradict thoſe Laws of Motion, which He alone at firſt Eſtabliſh'd, and which need His perpetual Concourſe to be Upheld.

The Laws of Method would oblige me to conclude here this Section, and paſs on to another: But in regard that all I thought my ſelf oblig'd to ſay about it, leaves it ſo very ſhort, as to be very Diſproportionate in Bulk to the other Sections of this Diſcourſe; I will crave leave to lengthen it in this place, with Something, which, tho' it may be judg'd to belong more properly to Another, will not perhaps be thought to be impertinent Here;

and much leſs to be uſeleſs to the deſign of this Diſcourſe.

Here then you may pleaſe to take notice, that in all that I have diſcours'd in the ſecond Section, or may elſewhere have occaſion to ſay; againſt the receiv'd Opinion, *that the whole material World was made for Man*; I would not be underſtood to ſpeak either too dogmatically, or too excluſively: my deſign being to deliver, what I thought might probably be repreſented, to take off the Prejudice, that Men are generally prepoſſeſs'd with in their own favour. For, *tho'* the Arguments I alledge Againſt the vulgar Opinion, ſeem as yet to me more probable than thoſe I have hitherto met with For it, eſpecially as it relates to the vaſt Cæleſtial Region of the World; *yet* I am *not only* willing to grant, that, among the Ends deſign'd by the Authour of Nature in *ſeveral* of his Works, eſpecially Plants, Animals and Metals; the

Utility of men may be one, and perhaps one of the principal: *but* I am not averſe from thinking, that Humane Ends, (or Uſes that relate to Men,) may have been deſign'd by God in ſeveral Creatures, whoſe *Humane Uſes* Men are not yet aware of: And that he may have intended, that of ſeveral of his Creatures, whereof Men do already know, and make *ſome* Uſes, they ſhall hereafter diſcover *other* Utilities, and perhaps *nobler* Ones.

Thoſe that reflect on the Providence of God, whilſt they repreſent what they call *Nature* as a Step-mother to *Man*, whom She brings Naked, Toothleſs, and Helpleſs into the World; whilſt She furniſhes the new Born *Fœtus's* of Brutes with Wooll or other Clothing, and both with a Power to Walk and Seek their Food, and (as to many of them) with Teeth to Eat it: Thoſe men, I ſay, have been long ago anſwer'd by the Eloquent

Lactantius, and other Champions of Providence. And therefore I ſhall only add this, that God *by* giving Man *Neceſſity* and *Reaſon*, has effectually Excited him, and richly Furniſht Him with Ability, to procure for himſelf far greater Accommodations and Advantages, than thoſe Beaſts come into the world with; and *by* vouchſafing him that Noble Faculty of Underſtanding, He has put it in his Power to convert to his own uſe thoſe very Things, for which Profane Wits would have the Condition of Beaſts preferable to His. For Man, by his Reaſon imploying skilfully ſuch Admirable Inſtruments as his Hands, is able to Maſter and Apply to his own Uſes, *the* fierceneſs of ſeveral Wild Beaſts, as Leopards (which the Perſians Hunt with,) *the* vaſt ſtrength of Elephants, *the* huge bulk of Whales, *the* Sagacity of Spaniels, Hounds, and Setters, *the* Swiftneſs of Grey-Hounds, *the* Suttlety of Tumblers, and *the* Furs of Beavers, Martins, *&c.* To omit a Multitude of others, which God, by the ſingle Gift of Reaſon to Man, has inabled him to maſter and make uſe of to his own advantage. And tho' at firſt he be helpleſs enough, and unable to exerciſe his Dominion over inferiour Creatures; yet God has ſufficiently provided for Him, by giving his Parents whilſt he needs them, that στοργὴ Natural affection for Him, which engages them to take care of him, till he be in a condition to take care of himſelf; and become qualify'd to obtain ſuch knowledge and Induſtry, as may make him Poſſeſſor of the advantages, whereof his Indulgent and Bountiful Creatour made him capable.

Thoſe Moderns that think it rediculous to Imagine, that, in framing ſuch Vaſt Bodies as the Earth, and ſome of the Cæleſtial Globes, their Creatour ſhould have any Regard to ſo ſmall a Part of the Earth as Man, and deſign'd that They ſhould be ſome way or other ſerviceable to him, look upon Things rather as *Surveyers*, who conſider mainly their Extent, than as *Philoſophers*, that Eſtimate them by their Intrinſick Value. For tho' it be true, that Man conſider'dbarely asan *Animal*,is a Creature little enough to be Contemptible; yet as He is endow'd with a *Soul* Immaterial, Rational, and Immortal, he is a Creature much more Noble and Excellent than the whole Terraqueous Globe, or a much vaſter Maſſe of Corporeal Subſtance that is Stupid and Inanimate. For the Rational *Soul* is capaof Underſtanding and Willing, (which are higher Faculties than meer *Matter* can reach to) and which is more,of Knowing, Serving and Enjoying God. And Man being the only Viſible Creature, that is capable toUnderſtand the Wiſdom, Power, and Beneficence of God in the Creation, and in many ways to Subdue a great Variety of the other Creatures, and Apply them to his

Uſes: it ought not to ſeem ſtrange, that the Wiſe Author of the Univerſe, that made all things ſo as to bring Glory to himſelf, ſhould have a more eſpecial regard to ſo Noble a Piece of his Workmanſhip, than to any, that being meerly Corporeal, can neither Underſtand his Wiſdom and his Power, nor Render him thanks nor Praiſes for the Manifold and admirable Effects of them. And that Littleneſs that is alledged to make Man a Contemptible Creature, is ſo far from being a Diſparagement to that Noble part of him, the *Soul*, which makes him a Man, that is, a *Rational Creature*; that its Excellency conſiſts in being leſs than the Minuteſt Body; Since not having Extenſion, it is not Diviſible; which is the Prerogative of Subſtances, which, for that reaſon, are Immaterial and Immortal.

This mention of the Human Mind leads me to a further Reflexion, which is, That many parts of the

Material World, whereof Man has not been known to make any advantage, in the Capacity of a meer *Animal*, may yet be highly uſeful to him, as he is a *Rational Creature*, that is, Capable, by Contemplating the great and Admirable Works of God, to Raiſe his Mind to the acknowledgment of the Divine Architects Power, Wiſdom, and Beneficence, and thereby Find produc'd in him due Sentiments of Veneration, Gratitude and Love. And Theſe may be ſafely reckon'd among thoſe Ends or Uſes, which in the firſt Section we have Styl'd *Human Ones*; Since ſome of the Heathen Philoſophers themſelves call'd the World a *Temple*, and one of the more Philoſophical Fathers of the Church loftily Styles it, παιδευτήριον τῆς θεογνωσίας, ϗ ψυχῶν λογικῶν διδασκαλεῖον.

And indeed we find, that the Pſalmiſt alone may furniſh us with divers Inſtances to our preſent purpoſe. For *Pſal.xix.* 1,2,3. not only He teaches us that *the Heavens declare the Glory of God*, and that in a Language, that, notwithſtanding what happen'd at *Babel*, reaches to all the Nations of the World; but He imploys the Contemplation of Gods Viſible Works, to excite in himſelf and others true Sentiments, both of Devotion and of particular Vertues.

Thus the Conſideration of his having been *wonderfully form'd* in his Mothers Womb, moves Him to Revere and Celebrate the admirable Skill of the Opificer. Elſewhere the Conſideration of the Regular Viciſſitudes obſervable in the courſe of Nature, invite him to Admire and Extoll the Providence of God. And when in another place, He beholds thoſe Vaſt Bodies and Shining Ones, that compoſe and adorn the Cœleſtial part of the World, he juſtly falls into Sentiments of great Hu-

Ps. CXXXIX. 14.

Pſal. civ. *thorow-out eſpecially* v.24.

Pſa. viij. 3. 4.

Humility and deſerved Gratitude.

And as to This Uſe, the Diſtance; and Vaſtneſs of the fixt Starrs, the Immenſity of the Heavens, and the Regular Motion of the Superiour Planets, (ſuppoſing they can bring Man no other advantage) may do him good Service; ſince they afford him Rational and Solid Grounds to believe, admire, adore, and obey the Deity. For by thus Spiritualizing (if I may ſo ſpeak) the Corporeal works of God, there may accrew to the Pious Soul, Uſes far more valuable than they can afford the Body; ſince they will Perfectionate the Mind here, and Continue to be advantagious to it, when the Body will not need the World, and the World it ſelf, as to its preſent Conſtitution, ſhall be deſtroy'd.

But to proceed from this Uſe of the World, which is Theological, to a Humane Uſe, that is more Phyſical,

ſical, as relating to the preſent welfare of Man, as he is an *Animal*, as well as a *Rational Creature*: I ſhall repreſent That, *as* a Nation is oftentimes, in the account of Providence, conſider'd as one Man, notwithſtanding Its various diſperſions, and perhaps long continuance; as the Iſraelitiſh People, during many Ages, notwithſtanding its Diviſions and Captivities, was addreſs'd to and treated, by the Prophets and Apoſtles commiſſion'd by God, as one Perſon, nam'd *Iſrael*, whom God ſomtimes in the Scripture is pleas'd to call his *Son*: *ſo* perhaps it will not be abſurd to conceive, that Mankind it ſelf may in ſome regards, or as to ſome purpoſes, be lookt upon by its Author as one Man, who, by Succeſſive Improvements of his knowledge, may from time to time be enabled to make New and conſiderable Uſes of the things, that the Wiſe and bountiful Providence of his Maker had fram'd, with a Foreſight

Exod. 4. 22.
Hoſ. 11. 1.

ſight that he would, and with Intention that he might, make them advantagious to him. And therefore it cannot ſafely be concluded That every thing whoſe Uſefulneſs to Man is not yet obvious, nay, That every thing that ſeems hurtful to him, can never be made beneficial to him. For we ſee that *Opium* was for many ages look'd on only as a Poyſon, but now is imploy'd as a Noble Remedy, (as indeed it is, if skilfully prepar'd & Judiciouſly exhibited) in many Violent, and oftentimes Dangerous, Diſtempers. *Vipers* are Venemous Animals; but yet their Fleſh is a main Ingredient of that famous Antidote *Treacle*; and being in great part Diſſolv'd in Tract of Time in good Spaniſh Wine, I have try'd it with Surprizing Succeſs, in an uncommon and very difficult Caſe. Scorpions alſo afford, by bare Infuſion, an Oyl that not only Cures their own Stings, but is very available in ſeveral Diſtempers. And I remember, that a learned ed Profeſſor of *Padua*, having Cured the Widow of a Soveraigne Prince of a Fit of the Stone, anſwer'd me ſome few Days after, that the chief Remedy he Imploy'd and Rely'd on, was a Preparation (which he intimated to Conſiſt mainly in a light kind of Calcination) of Scorpions, which, ſomewhat to my Wonder, he made his Patient take inwardly. And, tho' the Roots of *Maudioca* be reckon'd among Poyſons, when the Juice is in them, of which I elſewhere relate a Notable Inſtance; yet, when the Juice is Preſs'd out, and the Firm part reduc'd to Meal, it affords the *Caſſava*, which is the Common Bread of a great Part of the *Americans*: and I did not ſcruple to Eat of it here in *England*. Nay the Poyſonous Juice it ſelf, in Divers places of the Weſt Indies, is even by the unskilful Inhabitants turn'd into an Ordinary, and by them beloved Drink. But enough of this ſort of Inſtances; I ſhall be more Brief in thoſe of another Kind, whereof the firſt is afforded by the Loadſtone, which, tho' for many Ages admir'd by Greeks and Romans, for what is Commonly call'd its Attractive Vertue, had not its Directive Vertue known, at leaſt any thing Vulgarly, in theſe parts of the World, till within leſs than four Ages; Since when, of what Vaſt Uſe this Stone has prov'd to Mankind, the diſcovery of the *Weſt-Indies*, and of the Way of Sailing by the Cape of good *Hope* to the *Eaſt-Indies*, ſufficiently declares. I will ſay nothing of the Uſes of the Silk Worm, and the Sugar-Cane, which were little taken Notice of for many Ages, even by the Civiliz'd and Luxurious Greeks and Romans; but now, together with the lately diſcover'd *Cocheneal*, which is but an Inſect, and far leſs than the Silk Worm, make a good part of the Trade of *Europe*, and furniſhes the Tables of the Delicate with Sweet meats, and the Courts of Princes with many of their Fineſt Ornaments.

But not to inſiſt on ſuch things as theſe, but to proceed.

It deſerves alſo to be conſider'd on this occaſion, That many Things that are not thought Uſeful to Men, becauſe we ſee not that they directly bring in many Immediate Advantages, may yet be of great Uſe to them, as they Miniſter to, or are Neceſſary for, other things that are very ſerviceable to them. As the exceſſive Rains that cauſe the overflowings of Rivers in divers parts of *Africk*, and ſome other Countries, tho' they ſeem rather Deſtructive than profitable, do yet, by their ſeaſonable Inundations, make *Egypt* and ſome other Countries exceeding Fertile, that without them would be very Barren: and among Us, thoſe Clouds that do us no Immediate Service, do oftentimes, by Watering our Fields and Gardens in Summer, and by Manuring them, as 'twere, in Winter, do Nouriſh thoſe Trees, Graſs, Corn, Herbs, and other Plants, whereof ſome Serve immediately for Aliments to Man, and others are neceſſary for the nouriſhment of Sheep, Oxen, Deer, and other Beaſts that Men uſually feed upon.

Not only Plants, and Animals, and Stones, and Metals, and ſuch other ſmaller Bodies as are within Mans reach, are capable of being made uſe of by Him; but to advance a Step farther, to far greater Maſſes of Matter, and even ſome of thoſe remote Cæleſtial Globes, which he is thought able only to Contemplate; One of thoſe Ends, to which the Indulgent Creatour deſtinated them, may be To be ſerviceable to Man.

To ſay nothing of the advantage that skilſul Seamen make of the Ebbing and Flowing of that vaſt Collection of Waters, the *Ocean*; The Declination of the *Mariners Needle*, and the Variation of it, which probably depends upon the Motitions or changes of ſome Vaſt Internal Portion of the Terraqueous Globe, is found to be of great Uſe by Experienc'd Pilots and Navigators, in their Voyages through thoſe Vaſt Seas they uſe to paſs, between *Europe* and the *Eaſt-Indies*; as I learnt by particular Enquiry, from Eminent Perſons, that have more than once Sail'd upon thoſe *Seas*. The *Moon*, to omit her Light, ſerves Men, not only to make Moon-Dials by, and to foretell regularly the Times and Quantities of the Various Ebbings and Flowings of the *Sea*, the knowledge of which is very Beneficial, if not neceſſary, to Mariners, but ſerves Mathematicians for Divers other Purpoſes. The *Sun*, not to mention his ordinary Light and Heat, and the neceſſity of them to the Plants and Animals that afford Man Food and Medicines, and to the Production of many other Effects; whereon his Welfare depends, do inable him, by Concave and convext Glaſſes, to burn with Cœleſtial Beams, without the help of Culinary Fire; and enable the Gnomoniſt *to* make Accurate Dials, to know exactly how the Time paſſes; the Coſmographer, *to* make very uſeful Diſcoveries of the Elevation of the Pole, and Latitudes of Places; and the heedful Obſerver of his Riſing and Setting, *to* diſcover what Artiſts call his *Amplitude*, which is of good uſe to Aſtronomers, and more to Navigators, by helping them to eſtimate, among other things, the Variation of the Compaſs, (from true North and South Points.) And the Conjunction or Oppoſition of the Sun and Moon in Ecclipſes, tho' it be a frightful thing to the Superſtitious Vulgar, yet to Knowing Men, that can Skilfully apply them, theſe Ecclipſes are of great Uſe, and ſuch as common Heads would never have Imagin'd; Since not only They may, on divers occaſions, help to ſettle Chronology, and rectify the Miſtakes of Hiſtorians, that writ many Ages ago; but, which is, tho' a leſs Wonder, yet of greater Utility, They are, as things yet ſtand, neceſſary to define with competent Certainty, the Longitude of Places or Points aſſign'd on the Terraqueous Globe; which is a thing of very great moment, not only to Geography, but to the moſt uſeful and important Art of Navigation. And laſtly, at how ſtupendious a diſtance ſoever the Fixt Stars are plac'd, yet their remoteneſs cannot hinder the Induſtry of Man, from making even Theſe Serviceable to his Uſes; Since, if we ſhould admit thoſe determinate Cœleſtial Influences that are little leſs than the Idols of Aſtrologers, they would enable us to predict the Changes of Weather, the Fertility and Dearth, the Sickline ſs, or Healthineſs, of any propos'd Seaſon; and, not to lay any ſtreſs upon ſo Controverted a Science, 'tis plain that Skilful Navigators can make uſe of any of the fixt Stars, to know by any of them, what Hour 'tis of the Night: And 'tis more known, that Fiſhermen and Pilots did generally for many Ages, till within theſe four laſt Centuries, make very great uſe of the Pole-Star, and other of the Northern fixt Ones, to guide them, when nothing elſe could, in the perilous Courſes of their Navigations.

I have ſeen, and been Maſter of a Teleſcope, made in the form of a Walking-Staff, ſo that it was fitted to ſerve for ſeveral purpoſes; whereof tho' one was very different from the other, yet all of them were in the *Idæa* of the Artificer, and intended by him. The like may be ſaid of a Concave Metalline Burning-Glaſs; which, *tho'* it is imploy'd *to* magnify the Pictures of Objects, *to* caſt their Images into the Air, and *to* Concenter the Sun-beams to a *Focus*, in which they will burn ſeveral Bodies; *yet* Theſe and many other things, which, tho' they ſeem to have little Affinity with theſe, are perform'd by a Metalline Concave, were beforehand deſtinated by the Artiſt, who foreſaw and intended, that in ſuch various Junctures of Circumſtances, it ſhould produce all thoſe determinate Effects.

And indeed, if we conſider Gods Omniſcience and Providence, and how Indulgent a *Creator* he has been to *Man*; it may well ſeem reaſonable to think, that *as* God foreſaw that Men *might* make very various and profitable Uſes of divers of his other Creatures, by the help of that Prerogative of Reaſon, which he had vouchſaf'd them; *So* he deſign'd that Men *ſhould* reap the Advantages he had made many of his other Works capable of affording them. And I confeſs, I think this Reflection may juſtly ſerve to Recommend the Doctrine about Final Cauſes that we embrace, to Philoſophers that are truly pious: Since it furniſhes them with juſt Arguments for Gratitude to the Author of ſo many good things, as the Corporeal World, by being contemplated or poſſeſt, affords them. For to look upon the World, as vaſt and curious a Work as it is, only as a vaſt and curious piece of Workmanſhip; may indeed give a Man a great *Idæa* of the Power and Skill of the Divine Architect: But will rather exact his Wonder, than his Gratitude. And therefore the Ancient Ariſtotelians, who look'd upon the World as Eternal and Self-exiſtent in a Condition like its preſent Syſtem; did not uſe to Thank *God* for the Benefits they receiv'd from things Corporeal: Tho' ſome of them thought themſelves Oblig'd to thank *Nature*; which they look'd upon as acting with Deſign, and propoſing to her Self for Ends, the Welfare of the Univerſe, and of Men. To illuſtrate this with ſomething, whoſe Application is Obvious. If a Traveller being in ſome Ill-inhabited Eaſtern Country, ſhould come to a large and fair Building, ſuch as One of the moſt Stately of thoſe they call *Caravanzeras*; tho' He would eſteem, and be delighted with the Magnificence of the Structure, and the Commodiouſneſs of the Apartments; yet ſuppoſing it to have been Erected but for the Honour or the Pleaſure of the Founder, He would *Commend* ſo ſtately a Fabrick, without *thanking* him for it. But if he were Satisfied that this Commodious Building was deſign'd by the Founder, as a Receptacle for Paſſengers, who were freely to have the Uſe of the many Conveniencies the Apartments afforded; he would then think himſelf oblig'd, not only to Praiſe the Magnificence, but with Gratitude to acknowledge the Bounty, and the Philanthropy of ſo Munificent a Benefactor.

SECT. IV.

IT remains now, that we diſcourſe a while of the *Fourth* and laſt Queſtion, propos'd at the beginning of this Tract; which was, *With what Cautions Final Cauſes are to be Conſider'd by the Naturaliſt?*

But the Caſes whereto this Queſtion may relate, are ſo many and ſo differing, that, what I ſhall endeavour upon ſo diffus'd and difficult a Subject, will be rather to point you out ſome Sea-Marks, that may direct you to ſhun thoſe latent Rocks, againſt which divers Learned Men have daſh'd; than to preſent you with a Mariners Compaſs, and a Sea-Card, that may conſtantly guide you in the Courſes of your

Navigation, through ſo unfrequented a Sea.

And, to make way for what I am to offer by a Diſtinction, the want of which ſeems to have contributed to the Obſcurity of my Subject; I ſhall obſerve to you, that there are two ways of Reaſoning from the Final Cauſes of Natural Things, that ought not to be Confounded. For, Sometimes from the Uſes of things Men draw Arguments that relate to the Author of Nature, and the General Ends he is ſuppos'd to have intended in things Corporeal: As, when from the manifeſt Uſefulneſs of the Eyes, and all its parts, to the Function of Seeing, Men infer, that at the Beginning of Things the Eye was fram'd by a very Intelligent Being, that had a particular care, that Animals, eſpecially Men, ſhould be furniſh'd with the fitteſt Organ of ſo neceſſary a Senſe as that of Sight. And Sometimes alſo, upon the ſuppoſed Ends of things Men Ground Arguments, both Affirmative and Negative, about the peculiar Nature of the Things themſelves; and Conclude, that This Affection of a Natural Body or Part ought to be granted, or That to be denyed, becauſe by This, and not by That, or by This more than by That, the End deſign'd by Nature may be beſt and moſt conveniently attain'd. This latter ſort of Arguments I am wont to call purely or ſimply, *Phyſical* Ones; and thoſe of the former ſorts may, for diſtinctions ſake, be ſtyl'd *Phyſico-Theological* Ones; or (if we will with *Verulamius* refer Final Cauſes to the Metaphyſicks,) by a ſomewhat ſhorter name, *Metaphyſical* Ones.

What has been premiſed about theſe Two Ways of Arguing, allows me to proceed to what I ſhall venture, tho' not without much diffidence, to offer you, concerning our Grand Queſttion about; which I ſhall refer my preſent Thoughts to the Five enſueing Propoſitions.

PROP.

PROP. I.

AS to the Generality of Celeſtial Bodys, it ſeems not ſafe to propound Arguments of their Nature, from the ſuppoſition of particular Ends, at leaſt of the Human ones, deſign'd by the Author of Nature in framing them.

I will not only Allow you, but Encourage you, to take a Riſe from the Contemplation of the Celeſtial Part of the World, and the Shining Globes that Adorn it, and eſpecially the *Sun* and *Moon*; To Admire the Stupendious Power and Wiſdom of Him that was able to frame ſuch Immenſe Bodys, and, notwithſtanding their Vaſt Bulk, and (if the Earth ſtand ſtill) ſcarce conceiveable

able Rapidity, keep them for ſo ma- Ages, ſo Conſtant, both to the Lines and Paces of their Motion, without juſtling or interfereing with one another. And I ſhall moſt willingly joyn with you, in returning Thanks and Praiſes to the Divine Providence and Goodneſs, for having *ſo* plac'd the *Sun* and *Moon*, and determin'd the former (or the Earth) to move in *ſuch Lines*, under that Oblique Circle Aſtronomers call the *Ecliptick*, *that* there needs Skill in Coſmography to be able to Apprehend, how uſeful theſe Situations and Motions are, for the Good of Men and other Animals; and how diſadvantageous it would have been to the Inhabitants of the Earth, if the Luminaries had been otherwiſe plac'd or moved than they are. But for all this, I dare not imitate Their Boldneſs, that not only affirm, that the *Sun* and *Moon*, and all the *Stars*, and other Celeſtial Bodys, were made ſolely for the uſe of Man; but Preſume to ground Arguments, to evince ſuch a Syſtem of the World to be True, and ſuch another Erroneous, becauſe the Former is, as they think, better fitted to the Conveniency of Mankind, or the other leſs ſuited to that End, or perhaps altogether Uſeleſs or unneceſſary to it: As when they Argue, that the *Sun* and other vaſt Globes of Light, ought to be in perpetual Motion to Shine upon the Earth; becauſe, as They fancy, 'tis more convenient for Man, that thoſe Diſtant Bodys, than that the *Earth*, which is His Habitation, ſhould be kept in Motion. But, conſidering things as meer Naturaliſts, it ſeems not very likely, that a moſt Wiſe Agent ſhould have Made ſuch vaſt Bodys, as the Sun and the fixt Stars, eſpecially if we ſuppoſe them to Move with that Inconceiveable Rapidity that Vulgar Aſtronomers Do and Muſt aſſign them; Only or Chiefly to Illuminate a little Globe, that without *Hyperbole* is but a Phyſical Point, in compariſon of the Immenſe Spaces compris'd under the Name of *Heaven*; whoſe Lights might as well Illuminate the Earth, if They were a thouſand times Leſſer than they are, provided they were plac'd at a proportionably Leſs Diſtance from It. And 'twill be very hard to Aſſign, *what* conſiderable Uſe the Terreſtrial Globe or its Inhabitants Derive, from that Multitude of Celeſtial Globes that make the *Milky Way*; ſince each of thoſe Stars is ſo far from being ſingly able to Inlighten the Earth, that *Ariſtotle*, and the generality of Philoſophers for many Ages, (therein followd by divers of the Peripatetick Schools at this day) took the whole Aggregate of them for a *Meteor*. And *what* Light, or other known Advantage, can the Earth or its Inhabitants Derive from thoſe many Fixt Stars that the Teleſcope only can diſcover, (and which for that reaſon I ſometimes call *Teleſcopical* Stars) among the ſix or ſeven Conſpicuous Ones of the *Pleiades*, or among thoſe that the NakedEye can ſee in the *Belt* or *Girdle* of *Orion*? which (Conſtellations) I ſcarce ever look upon, through a good Teleſcope, without Wonder.

I foreſee, it may be ſaid, that Theſe and other the like Celeſtial Bodys may be at leaſt Thus far Uſeful to Man, as to Diſcover to him, and give him a Riſe to Admire and Praiſe, the Greatneſs and Power of the Divine Maker: And if this be ſaid, I ſhall not quarrel with the Allegation, but readily grant, that, tho' perhaps his Wiſdom ſhines as bright to Us Men, in the Structure of a Gloworm, as in the Diſpoſition of the unſeen Stars that make up the *Galaxy*; yet the Immenſity of his Power could not perhaps be ſo well declar'd by leſs Vaſt Productions of it. But ſtill theſe Arguments are not purely *Phyſical*, but of that ſort that I call *Phyſico-Theological*, whoſe Inferences Relate to the General Intendments of God in the

Univerſe, which I therefore Style *Coſmical Ends*; but do not reach to Prove any thing about the determinate Nature of particular Bodys. And ſince the Utmoſt that Philoſophy teaches us, is, that in general the Good of Man was One of the Ends deſign'd by God, in ſo framing the World as we ſee it is fram'd: There may be other Ends deſign'd by the ſame Omniſcient Author of Nature, of thoſe Teleſcopical and other Small or Remote Stars, whoſe Uſes to Us are doubtful or inconſiderable; towards the attainment of which Ends, thoſe Celeſtial Bodies and Motions may be admirably contriv'd and directed. And, We not being able by meer Reaſon to Inveſtigate what thoſe Ends are, tho' we have not near ſo much Reaſon to aſſure us that there *may not be* ſuch Ends, as the Infiniteneſs of God's Wiſdom gives us to think there *may be*; 'tis Preſumptuous for Us to Judge of the Syſtem of the World, and of the Deſtinations of

Fixt Stars ſo Remote, that, tho' they be probably like ſo many Suns, We cannot ſo much as Diſcern them without good Teleſcopes, By That Syſttems Greater or Leſſer Advantageouſneſs to Us: Eſpecially, ſince tho' it were certain that, among other Uſes, God intended they ſhould be in ſome ſort Serviceable to Us, yet he has no way declared to us, in what Capacity, or to what Degree, they ſhall be Uſeful to Us. And therefore if they be ſo in any Meaſure (as for example Mentally,) they are So, for what we know, as much as He deſign'd they ſhould be: and That it ſelf being an unmerited Favor, deſerves our humble Thanks. And it ſeems very likely, that God did not deſign to all the parts of the Earth it ſelf, Equal, and conſequently not the Greateſt, Advantages by the preſent Syſteme of the Univerſe; ſince the Countries Inhabited by the *Samoids* and *Novazemblans*, and other Nations that like very near the

Arctick Pole, want many Conveniencies and Advantages enjoy'd by the Inhabitants of the *Temperate Zones*, that lye nearer the Way in which the Sun moves.

But, tho' *bare Philoſophy* does not favour the Bold Opinion I dare not aſſent to; yet I know, 'twill be pretended, that *Revelation* does. And I readily confeſs, *that* the Terraqueous Globe, and its Productions, (among which perhaps the Atmoſphere may be reckoned) and eſpecially the Plants and Animals 'tis furniſh'd with, do by the *Scripture* appear to have been deſign'd for the Uſe and Benefit of Man, who has therefore a Right to Imploy as many of them, as he is able to Subdue: and *that* the two Luminaries themſelves, the Sun and Moon, were appointed by God to give Light upon the Earth, and be uſeful to all the Nations that Inhabit it: And *that* therefore the Kingly Prophet had reaſon to exclaim,

Pſ. 104. 19..

claim, *How manifold are thy works O Lord! How wiſely haſt thou made them all!* *Pſal.* 104. 24. when in the precedent and ſubſequent words, he applys this to the Terraqueous Globe, and its Inhabitants. And He might juſtly ſay, as he elſewhere did, *That the Heavens declare the Glory of* God, *and the Firmament ſheweth his handy Work.* But theſe General Declarati- *Pſal.* 19. 1. ons, tho' they be juſt Motives of our Wonder and Thankfulneſs; yet I fear they are not good Topicks to draw ſuch Phyſical Concluſions from, in particular Caſes, as ſome Learned Men adventure to do. For I do not remembar, that 'tis any where declar'd in the *Scripture*, that the Service of Man was the Only, or perhaps ſo much as the Chief, Uſe of all the Celeſtial Lights, and other Bodys of that Immenſe Part of the World. And This Single Conſideration ought to oblige us, to be very wary in making Aſcriptions to our ſelves, as if the Great Syſtem of the World were to be eſtimated by Our Conveniencies. And if it be ſaid, that Things meerly Corporeal *have not*, and Man alone *has*, a Rational faculty, whereby to Refer the great & wonderful Works of God to the Glory of their Maker; I ſhall take the Liberty to anſwer, that, tho this has been Affirm'd by Many, if not alſo Aſſented to by All, yet I have not found it prov'd by Any. And I ſomewhat wonder, that Divines ſhould on this Occaſion overlook that paſſage in the 38th. Chapter of *Job*, which they generally interpret of the Angels. For the Queſtion, which God there puts to *Job*, may be juſtly applyed to *Adam* himſelf; *Where waſt thou when I laid the Foundations of the Earth? Declare if thou haſt underſtanding. When the Morning Starrs ſang together and all the Sons of God ſhouted for joy.* And indeed, if We

Job. 38. 5. 4. 7.

We even may preſume to Conjecture of ſuch things, it ſeems to me reaſonable to think, that God created the Angels before the Material World, thar He might have Intelligent Beings to pay him the juſt Tribute of Praiſes, for ſo Admirable a Spectacle as That of the *Riſeing World*, or rather the Beginning and Progreſs of the Creation. However by the words laſt Cited out of the Book of *Job*, it appears, that before Man was made (for that he was not till the 6th. day) God wanted not Intelligent Spectators and Applauders of his Corporeal Works. And ſince the *Angels* are a Nobler Order of Intellectual Creatures than *Men*, and are not Unconcern'd Spectators of the Works of God: How do we know, but that ~~*in*~~ the Syſteme of That Part of Heaven, of which we need Teleſcopes to Know that there is ſuch a thing *in rerum Natura*; and *in* the Plants, Animals, or other furniture, what ever it be, of in making Aſcriptions to our ſelves, as if the Great Syſtem of the World were to be eſtimated by Our Conveniencies. And if it be ſaid, that Things meerly Corporeal *have not*, and Man alone *has*, a Rational faculty, whereby to Refer the great & wonderful Works of God to the Glory of their Maker; I ſhall take the Liberty to anſwer, that, tho this has been Affirm'd by Many, if not alſo Aſſented to by All, yet I have not found it prov'd by Any. And I ſomewhat wonder, that Divines ſhould on this Occaſion overlook that paſſage in the 38th. Chapter of *Job*, which they generally interpret of the Angels. For the Queſtion, which God there puts to *Job*, may be juſtly applyed to *Adam* himſelf; *Job.* 38. 5. 4. 7. *Where waſt thou when I laid the Foundations of the Earth? Declare if thou haſt underſtanding. When the Morning Starrs ſang together and all the Sons of* God *ſhouted for joy.* And indeed, if

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To what has been hitherto ſaid, to let you ſee the Reaſonableneſs of my *firſt* Caution, which repreſents the Making Particular and meerly Phyſical Inferences from the ſuppoſed Deſtinations of Celeſtial Bodyes, as a thing Unſafe, I ſhall now add in the *Second* place;

That 'tis yet more unſafe, to ground Arguments of the Nature of particular Bodies that are Inanimate in the Sublunary World, upon the Uſes we think they were deſign'd for.

This will not appear an unreaſonable Caution if we conſider, How little we know of the Particular Purpoſes of Nature in thoſe Bodies here below, which not being Organical, like thoſe of Animals and Plants, cannot by the Curiouſneſs of their Structure diſcloſe to us the Particular Ends to which they were ordained. And as for their Motions, ſince they are extremely far from being ſo Conſtant and Regular as thoſe of the Celeſtial Bodies, the Caution we gave about drawing Arguments from the Syſtem of the *Heavens*, will not, ſure, be thought unfit to take place when we ſpeak of the *Clays*, *Chalks*, and *Stones*, and the like Terreſtrial Bodies, whoſe Textures are, comparatively to thoſe of Living Creatures, very Simple, and Slight, and ſeldom more Curious than may be made by Art, by Diſſolving Stones and Metals in Chymical Menſtruums, and afterwards Chryſtallizing the Solutions; of which I elſewhere give Examples. Tis true, that, tho' *Revelation* ſpeaks rather of Gods having deſtinated Animals and Vegetables, than Inanimate Bodyes, to the Service of Men; yet there is no abſurdity to conceive, that generally ſpeaking, That may be one of the Ends deſign'd by the Author of Nature, in making Metals, Stones, and thoſe other Inanimate parts of the Terreſtrial Globe that Man is able to maſter and make uſe of. But whereas in this Globe the Surface is diſtant from the Center, above three thouſand and five hundred Miles; and I do not find that either Mens Spades or their Plumming Lines have

See the Tract of the Origine and Vertues of Gems.

have reach'd above one Mile of that great number; Nor is it very likely, that Human Induſtry will ever make its way down to the Thouſandth part of that vaſt Depth: it ſeems very improbable, that the remaining Internal part of the Earth, that is above ſeven thouſand Miles thick, and may, for ought we know, contain great varieties of Foſſils and other Creatures, ſhould be made Chiefly or Only for the ſervice of Men, from whoſe ſight they lye hid in a deeper Well than that of *Democritus*; and who do not ſo much as know what kind of Bodies they are. And *tho'* it will not hence follow, that the Terraqueous Globe was made by Chance, no more than that any of the other Planets was ſo; becauſe the Admirable Structure of Plants and Animals evinces the Exiſtence and Providence of a moſt Wiſe and Powerful Author of things, who may juſtly be ſuppos'd to have made nothing in Vain, even among the Inanimate portions of our Globe, whoſe Animated portions are ſo wiſely and exquiſitely framed: *yet*, that *thoſe* Inanimate Bodies were made for determinate Ends, is more eaſy to be deduc'd from the knowledge we have by other *Mediums*, that they are the Productions of a Wiſe and Provident Author, than by the Contemplation of theſe Inanimate Bodies themſelves. And perhaps it may be worth Inquriry, whether ſome things may not be made, even by a wiſe Agent, not out of a Primary Intention, but as Productions that will naturally follow upon the Eſtabliſhment and Preſervation of thoſe grand Laws and Rules of Motion, that were moſt fit to be ſetled among Things Corporeal. And 'tis very poſſible, that according to that *Coſmical* Eſtabliſhment (if I may ſo call it,) many parts of the Terreſtrial Globe ſhould be ſo plac'd or diſpos'd of, as not to be ſerviceable to Men; becauſe the whole Aggregate, or Globulous Maſs, could not otherwiſe be ſo wel ſuited to the General Deſtinations of the Univerſe, which, if otherwiſe Contriv'd would perhaps have been leſs ſerviceable than now it is to Man himſelf. To Countenance which Conſideration, I ſhall obſerve, that, tho the Eclipſes of the Sun and Moon be uſually Unwelcom, and if Aſtrologers may be credited, often very Prejudicial to Multitudes of Men; yet the great *Former of all things*, or as the Original will bear it, *of the whole*, did not think fit to alter the Tracts or Lines of Motion, that he aſſigned the Luminaries, to avoid the Ecclipſes that muſt yearly enſue upon their Moveing in ſuch Lines. Whence we may alſo learn, that ſome *Phænomena* may not belong to the Primary Intention of Nature, but are only the neceſſary Conſequences and Effects, of the Primitive Conſtitution of the World, and the Catholick Laws of Motion. And

Jotzer haccol Jer. x. 16. &. L. 1. 12.

And if it be here demanded, what the Ends are, for which the Deep and hidden parts of the Terraqueous Globe, and the Teleſcopical Stars of the *Firmament*, were made; if they were not made for the Uſe of Man: I ſhall frankly anſwer, that I cannot tell: And I know not but ſuch an Anſwer may be more expreſſive of the profound Reverence we owe the great Author of Nature, than Their Opinion is, that would have all theſe made for the Uſe of Man: ſince, To ſay that we know not why ſome Part of a Work is made by an Artiſt, whom other parts proclaim to be moſt Wiſe and Skillful, does both Acknowledge our own Ignorance, and leave it highly probable that ſuch Pieces of Work are ſuited to Purpoſes worthy of Him, and ſuitable to Them; and ſeems therefore a ſafer and more reſpectful Opinion, than to ſuppoſe Him to have made ſuch things for a Particular End, which we connot make out to be in any conſiderable meaſure worthy of *his* Wiſdom, and attainable by *them*.

PROP.

PROP. II.

IN the Bodies of Animals 'tis oftentimes allowable for a Naturaliſt, from the manifeſt aud appoſite Uſes of the Parts, to Collect ſome of the Particular Ends to which Nature, deſtinated them. And in ſome caſes we may, from the known Natures as well as from the Structure, of the Parts, ground probable Conjectures (both Affirmative and Negative) about the Particular Offices of the parts,

To obviate miſtakes, you may pleaſe to take notice, *both* That in this Propoſition, I ſpeak only of thoſe Ends and Uſes of the Parts of an Animal, that relate to the Welfare and Propagation of the Animal it ſelf, and which therefore I formerly ly call'd *Animals Ends*: *and* yet that I do not thereby deny any Declaration that is made in the H. Scriptures, That God deſign'd that the Entire Animals, as well as their Parts, ſhould be in ſeveral ways ſerviceable to Man. And haveing premis'd this to explain my meaning in the Propoſition, I ſhall now conſider diſtinctly the two parts whereof it conſiſts.

And 1. There is no Part of Nature known to us, wherein the Conſideration of *Final Cauſes* may ſo juſtly take place, as in the Structure of the Bodies of Animals. And I confeſs, that when I aſſiſt at a well-adminiſter'd Anatomy, I do ſo wonder at the admirable Contrivance of a Humane Body, that I cannot but ſomewhat wonder, that there ſhould be found among Philoſophers, men that can aſcribe it to blind Chance The *Stoick*, that in *Cicero* asked an *Epicurean*, why Chance did not make Palaces and other Buildings, ſeems not to me to have made an impertinent Queſtion. For the commodiouseſt Houſes Mens Bodies dwell in, are far leſs curious Structures, than the Manſions their Souls reſide in: which you will not think a groundleſs Paradox, if you conſider, that, whereas even in a Palace, the Materials being Wood, Stone, Brick, Mortar, Glaſs, and four or five Metals, are but Few in compariſon of the Parts of differing Textures, as Bones, Nerves, Ligaments, Membranes, Muſcles, Veins, Arteries, Griſſels, Glandules, Jellys, Humours, *&c*; and their Diſpoſition is exceeding Slight, in compariſon of the curious and elaborate Contrivance of the numerous Parts, both ſolid and fluid, of the Human Body: whereof tho' the Stable Parts alone have been reckon'd to amount to ſome Hundreds; yet in Every One of theſe parts, the Bulk, Figure, Conſiſtence, Texture, Situation, Connexion and Aptneſs for motion, is the moſt Commodious that can be deviſed; and **All** of them are wonderfully Symmetrical, both to, one another and the whole Body; To divers of whoſe Motions, as Leaping, Running Speaking, Swimming, Sneezing *&c.* a great Number of them conſpire. And this Number of Parts is ſo artificially contrived and pack'd together, that tho' in a Body where no room is loſt, many Parts do at the ſame time exerciſe very differing Motions, yet each of them moves freely, and does not at all Hinder another, but rather they Promote each others Motions.

I will not ſuffer Indignation to tranſport me ſo far as to wiſh, That thoſe that deny the Uſefulneſs of all the Parts of their Bodys may fall Sick, or receive ſome Wound, to be thereby at once Convinc'd and Puniſh'd: But I will venture to ſay, that Diſeaſes or Hurts alone may ſhew, how excellently all the Parts of our Bodys are Contriv'd in order to our Welfare. For, if ſo much as a Finger be made Bigger by Tu-

mors,

mors, or Diſplac'd by being put out of Joynt, or kept in a Wrong Poſture by Contractions, or have its Continuity violated by Cutting, or its Tone chang'd by Strains or Contuſions, or its Senſe or Motion taken away by the Palſey, or its Membranes fretted by Sharp Humors, or its Motions Diſorder'd by the Cramp or Convulſions; In any of theſe Caſes we quickly find, how Commodiouſly the Parts Affected were Framed or Diſpos'd, when any Diſeaſe or Hurt gives them a Preternatural Conſtitution; that is, changes that Figure, Connexion, Tone, *&c*, which, according to the Inſtitution of Nature, whilſt the Body is in full Health, does belong to it.

The Eye (to ſingle out again that Part for an Inſtance) is *ſo* little fitted for almoſt any other Uſe in the Body, and is *ſo* exquiſitely adapted for the Uſe of Seeing, and That Uſe is *ſo* neceſſary for the welfare ſare of the Animal, *that* it may well be doubted, whether any Conſidering Man can really think, that It was not deſtinated to that Uſe. The ſix or ſeven Muſcles that move the whole Bulbe of the Eye, upwards, downwards, to the right Hand, to the left, and to various oblique Poſitions; and the ſeveral Coats and Humors that make up the Senſory, Have not only their Bigneſs, Shape, Conſiſtence, Situation and Connexion admirably Adapted to that End; but the Tranſparency of the *Cornea* and the Humors, the Opacity of the *Uvea*, and the Semi-opacity of the *Retina*, and the ſeveral Motions of the Parts of the Eye, being requiſite to Receive, Tranſmit, Refract, and Diſpoſe the Viſive Beams that come from the Object, after the manner requiſite to make the Livelieſt Picture of it in the Bottom of the Eye, Do no leſs concur to Compleat this matchleſs Organ of Viſion: which is ſo rarely Contrived in order to That Uſe, and comparatively ſo little to any Other, that there is no more Raſhneſs to ſay, that an Eye, than that a Teleſcope, was made for an Inſtrument to See with; that is, to Diſcover the Colours, Magnitudes, Shapes and Motions of Diſtant Objects. And in that admirable Perforation of the *Uvea*, which we call the *Pupil*, Nature has much outdone Art. For whereas We are fain to apply to the Object-Glaſſes of *Teleſcopes*, Opacous Bodys with ſeveral Circular Apertures, that Some may let in leſs Light, and Others more, according as the Objects are more or leſs Bright or Inlighten'd; That part of the *Uvea* that hangs in the Aqueous Humor, is an Aperture, as the Artiſts call it, that Narrows and Opens it ſelf in a trice, according to the exigency of the Objects we look on; Which if they be ſo conſtituted or plac'd, that they Reflect but a Dim Light, the Curtain is preſently drawn Open, and the *Pupil* circularly Widen'd, to let in the more

Beams of Light; and the Contrary happens, as often as the Object, being too Luminous or Illuſtrated, would offend the Organ, or diſturb the Sight, if the Contraction of the *Pupil* did not ſhut out ſome of Its Beams. But for the Uſes of the ſeveral parts of the Eye, I ſhall referr you to the Induſtrious Jeſuit *Scheiner*'s *Oculus*, and *Des Cartes* his excellent *Dioptricks*; where you will eaſily perceive, that, in Framing the Eye, Nature did not only act with Deſign, but with ſo much Skill in Opticks, that a more than ordinary inſight into that Science, is neceſſary to Underſtand the Wiſdom of the Contrivances; and perhaps no degree of Skill in it, would enable a man to Alter them for the better. 'Twere tedious to mention the Other Parts of the Body, that manifeſtly appear to have been preordain'd to certain Uſes. The Books of Anatomiſts are full of Paſſages applicable to this purpoſe; of which I ſhall ſay in general, that, tho' what they deliver ſuffices to ſhew, That all the Parts of the Body are the Effects of an Intelligent Cauſe: yet, unleſs their Deſcriptions and Reflexions be improv'd by Men vers'd in Mathematicks and Mechanicks, and, I ſhall venture to add, in Chymiſtry too; we ſhall but imperfectly underſtand, how Intelligent that Cauſe is, or how much Wiſdom it has diſplay'd, in the Structure of a Human Body and each of its parts.

I know 'tis objected by the *Epicureans*, that the Parts of Animals were firſt made, and their Uſes afterwards found out by mens Sagacity. But this is a Sophiſtical Objection. For, *firſt*, as to many of the Inner parts, as, the Heart, Liver, Spleen, Kidneys, *&c*,

Illud in his rebus vitium vehementer ineſto Effugere, illorumq; errorem premeditemur, Lumina qui faciunt Oculorum clara creata Proſpicere ut poſſimus, Lucret. de Nat. l. iv.

Nihil ideo quoniam natum eſt in Corpore ut uti poſſemus, ſed quod natum eſt, id procreat Vſum. Ibid.

They perform their Functious without ſo much as Our Knowledge of their Structure, or perhaps their Situation; ſo far are they from being applyed to ſuch Uſes by Our Sagacity. And as for the Limbs and other Parts, which we can Move at pleaſure; 'tis true, that they cannot be actually Imployed to the reſpective Uſes, till they be actually Form'd; but That hinders not but that in their Formation they were therefore ſo Formed, that they may be in due time fit for ſuch Uſes. And therefore we ſee, that the Chick is furniſhed with compleat Eyes, and with Wings and Feathers, before he be Hatch'd; tho' whilſt he is yet incloſ'd in the Egg, he can not make uſe of them to See or Flye. And why was it, do the *Epicureans* think, that Nature provided a whole Set of *Temporary* Parts for Pregnant Females, and Animals in the Womb, which, when they are come into a freer ſtate, partly fall away of themſelves, and partly turn to a Ligament, fitted no longer for the former, but for a more ſeaſonable Uſe? And 'tis to be noted, that the Production of theſe Umbilical Veſſels, and the *Placenta* or Analogous Body in the Womb to which they are faſten'd, is of no Neceſſity nor Uſe to the Female before Conception; and thereby thoſe Temporary Parts appear to have bin Deſign'd by Nature, not ſo much for the Perſonal Preſervation of the Female as for the Propagation of the *Species*: Which Deſtination not coming to be accompliſhed, till a Woman, for inſtance, has attain'd to a competent Age, appears to have been preordain'd by the Author of Mankind for the Continuation of It.

And *tho'* it be true, that the Sagacity of men may have found out ſome Uſes of ſome Parts of their Bodys, that cannot be made appear to have been Primarily Intended by the Author of Nature; *yet* That is no good Argument, that *thoſe* Uſes were not Intended, which either are made

Within us, or do, as it were obtrude themſelves Upon Us. And as for other Uſes, the Preſcience and Goodneſs of God are ſuch, that it ought not to appear incredible, That He that gave man both the Limbs of his Body, and the Rational Endowments of his Mind, and that has made many Parts, as the Eyes and the Ears, Double, that One may ſupply the want of the Other ; Did both Foreſee what Uſes men might, according to their Sagacitys and Emergencies, make of theſe Parts, and ſo Contrive the Parts that they ſhould be applicable to ſuch Uſes. Suppoſe, a Wiſe man ſhould ſend his Son to Travel, and among other things give him a Pocket-Dyal with a Magnetic Needle ; and this Traveller having loſt his way in ſome wild Plain, or being at Sea in a Veſſel, whoſe Compaſs was broken or ſpoyl'd by a Storm, or ſome other Miſchance : If, I ſay, in this caſe tho' the Traveller Ordinarily Imployed his Dyal only to find the Hour of the

Day, He ſhall now Imploy it to Guide his Courſe, or Steer the Veſſel, by the help of the Needles pointing Northward; tho' this would be an Effect of His own Sagacity, yet his Father being a Wiſe and Experienced Man, may reaſonably enough be ſuppos'd to have Foreſeen, that his Son might have need of knowing the Northern and Southern Points of the Horizon. And accordingly may have given him a Dial furniſh'd with a Magnetic Needle, rather than an Ordinary Gnomonic Dial. And ſo a Man that has taught another to Paint Landskips, when he gives him a Pencil and a Pallet furniſh'd with Colours, to draw a Particular Proſpect, is not to be ſuppos'd to have Deſign'd, that he ſhould not Imploy them to any other purpoſe, if Urgent Circumſtances made it requiſite for him to do ſo.

Having inſiſted longer than I intended upon the *former* part of my

Propoſition, I now proceed to the *latter*; namely, That in ſome caſes we may from the known Ends of Nature, as well as from the Structure of the Parts, ground Probable Conjectures, both Affirmative and Negative, about the particular Offices of the Parts. Which I could not ſeaſonably doe before, becauſe the Arguments, that were founded on the Uſes of the Parts of Animals, ſuppoſe, not only that thoſe Parts were deſtinated to Particular Uſes knowable by Us, but that the ſeveral Parts of the Body were Contrived as Wiſely and Commodiouſly as Men are able to Deviſe, in order to the Ends of Nature; which is always to be underſtood to have United in her Deſigns, the Uſes of the Parts, and the Welfare of the Whole.

And indeed if we conſider, how admirable a Fitneſs there is in the Parts of the Human Body, for inſtance, to thoſe Particular Ends we can diſcover them to have been Predeſign'd deſign'd for; it ſeems allowable to Conjecture, that ſuch a Part was not Primarily Deſign'd to ſuch an Uſe, becauſe it is, on the account of its Structure or otherwiſe, leſs Fitted for it, than the conſtant Wiſdom of Nature ſeems to require; eſpecially if there be any Other Parts, by which That Office may be more commodiouſly perform'd. And on the other ſide, it may be a Probable Ground, tho' not altogether ſo Probable as the former, to Conclude that ſuch a Part was Deſtinated to ſuch an Uſe, if the Uſe it ſelf appear to be neceſſary, and the Part better fitted for it than any Other is.

Thus, tho' Anatomical and Optical Writers, as well as the Schools, did for many ages unanimouſly conclude, the *Cryſtalline Humor* to be the Principal Seat of Viſion; yet the induſtrious *Scheiner*, in his uſeful Tract intituled *Oculus*, does Juſtly enough reject that receiv'd Opinion, by ſhewing, that it Suits not with the Skill and Providence of Nature, to make that Part the Seat (or chief Organ) of Viſion, for which it wants divers requiſite Qualifications, eſpecially moſt of theſe being to be found in the *Retina.* And I remember that when I asked our famous *Harvey*, in the only Diſcourſe I had with him, (which was but a while be fore he dyed) What were the things that induc'd him to think of a *Circulation of the Blood?* He anſwer'd me, that when he took notice that the Valves in the Veins of ſo many ſeveral Parts of the Body, were ſo Plac'd that they gave free paſſage to the Blood Towards the Heart, but oppos'd the paſſage of the Venal Blood the Contrary way: He was invited to imagine, that ſo Provident a Cauſe as Nature had not ſo Plac'd ſo many Valves without Deſign: and no Deſign ſeem'd more probable, than That, ſince the Blood could not well, becauſe of the interpoſing Valves, be Sent by the Veins to the Limbs; it ſhould be Sent through the Arteries, and Return through the Veins, whoſe Valves did not oppoſe its courſe that way.

Thus, whereas former Anatomiſts and Phyſicians generally believed the Nutrition of the Parts by the Venal Blood, the more Recent Writers are wont to teach, that the Parts are nouriſh'd by the Blood in its paſſage through the Arteries. Not that they Think, the Blood that runs through the Veins altogether unfit to Irrigate the Parts with that Vital Liquor; but that they Judge the Veins to be leſs fit than the Arteries, into which the Blood comes immediately from the left Ventricle of the Heart, Agitated and Spirituous, and with a brisk Impulſe, which forces out the *Particles* of the *Blood*, at thoſe *Pores* of the *Arteries* that they find Congruous to their Shape and Size, and which anſwer to the ſeveral Parts that are to be nouriſhed by Corpuſcles ſo Qualified. 'Twere not Difficult, if 'twere Neceſſary, to accumulate Inſtances to the ſame purpoſes with thoſe already mentioned; there being nothing more frequent in the Books of Anatomiſts, and thoſe that treat of the Phyſiological and Pathological parts of Phyſick, than to draw Arguments, as well Affirmative as Negative, about the Uſe of the Parts of the Body, from their Fitneſs or Unfitneſs, or their greater or leſſer Fitneſs, to attain ſuch Ends as are ſuppos'd to have been Deſign'd by Nature. And indeed theſe Argumentations occur ſo frequently, that I think there is leſs need of my Increaſing them, than of my Proceeding to give you a Caution about them, which I ſhall do in the following Propoſition.

PROP. III.

IT is Rational, from the Manifeſt Fitneſs of ſome things to Coſmical or Animal Ends or Uſes, to Infer that they were Fram'd or Ordain'd in reference thereunto, by an Intelligent and Deſigning Agent.

Divers things have Incidentally been ſaid in this Paper, eſpecially in the firſt Section of it, and others may hereafter be Occaſionally added, that may juſtly be imploy'd againſt that part of the *Epicurean Hypotheſis*, which Aſcribes the Origine of Things to *Chance*, and Rejects the Intereſt of a *Deity*, and the Deſigning of Ends, in the Production and Management of Natural things. But becauſe I obſerve, not without grief, that of late years too many, otherwiſe perhaps Ingenious Men, have with the Innocent Opinions of *Epicurus*, embrac'd thoſe Irreligious ones, wherein (as I was ſaying) the Deity and Providence are quite Excluded from having any Influence upon the Motions of Matter, all whoſe Productions are refer'd to the Caſual Concourſe of Atoms: For this Reaſon, I ſay, I thought it a part of my Duty, as well to the moſt Wiſe Author of Things, as to Their Excellent Contrivance, and Mutual Subſerviency, to ſay Something, tho' but briefly, yet diſtinctly and expreſly, to ſhew, That, at leaſt in the Structure and Nature of Animals, there are Things that argue a far Higher and Nobler Principle, than is Blind *Chance*. But, that I may do what I here intend, with as much brevity as I can, I will do little more than name ſome Particulars, that I have not obſerved to be ſo uſually reflected on, to the Purpoſe for which I mention them. And I ſhall Confirm theſe Conſiderations but with One Inſtance, and That too, taken from a Sort of Parts that are as little Elaborate, and therefore ſeem to be as little Fit for my Purpoſe, as almoſt any in the Humane Body.

I will not now inculcate what has been delivered, and may be farther ſaid, of that Exquiſite Structure of the Bodies of Dead Animals, that is diſcoverable by the Knives of Anatomiſts; (tho' I ſhall not Scrupulouſly forbear to touch lightly on a few things of that kind, that are requiſite to my Purpoſe:) My preſent Deſign being, to ſet down very briefly a few Arguments, to Strengthen the Propoſition lately delivered.

Firſt then, I obſerve, That there ſeems to have been Care taken, that the Body of an Animal ſhould be furniſhed, not only with all things that are Ordinarily Neceſſary and Convenient, but with ſome Superabundant Proviſion for Caſualties. Thus, *tho'* a Man may Live very well, and Propagate his Kind, (as many do,) tho' he have but One Eye; *yet* Nature is wont to furniſh Men with Two Eyes, that, if One be Deſtroyed or Diſeaſed, the Other may ſuffice for Viſion. And *ſo*, if One Ear grow Deaf, a Man may be Converſed with, by the help of the Other that remains Sound. In ſhort, Nature has furniſhed Men with Double Parts of the ſame Kind, where that Duplicity may be highly Uſeful, and can be permitted without Incongruity to the reſt of the Body. And this is the more Conſiderable, becauſe in Other Parts Nature appears to Husband things, ſo, as to Shun doing things Superfluous: As within the Skull, ſome Veſſels that would in other Parts of the Body have Double Coats like other Arteries, are much Thinner, almoſt like Veins; the Thickneſs of the Skull being ordinarily a ſufficient

Fence to them from External Injuries.

Another Argument, That divers Things that Nature does about Animals, are done with Deſign, may be taken from what Anatomiſts Obſerve of Thoſe Parts of the Womb or the *Fœtus*, that are to be found but at Certain Times, at which there is Need of them, and not at Others, when they would be Uſeleſs. Thus, when a Woman is with Child, the *Vaſa Umbilicalia* are produc'd, to be Channels either for the Blood or Alimental Juice and Spirits, that then ought to paſs between the Womb and the *Fœtus*; which is to be Nouriſhed, either only or chiefly, by the Liquors derived to It through thoſe Veſſels, aſſiſted by the *Placenta*, that Supply to it the want of Eating with the Mouth, which the Unborn Infant either does not at all, or does but very imperfectly, employ to Feed himſelf. And *though*, as long as he continues

Impriſon'd in the *Womb-ſtate*, theſe *Temporary Parts*, (if I may ſo call them) continue with him ; *yet*, as ſoon as he comes abroad into the World, theſe Umbilical Veſſels, particularly the Two Arteries and the Vein, together with the Membranes they are wrapt up in, and Thoſe (commonly call'd the *Chorion* and the *Amnios*,) that Involve the *Fœtus*, are Thrown off, as Unneceſſary to the Born Infant's New State ; and when It has quitted the Womb, are Expell'd after it, whence they are call'd the *After-birth* ; there remaining only that Part of the Umbilical Veſſels that lies within the Child's *Abdomen*, between the Navel and the Liver, where its Uſe is Conſiderable, tho' New ; it Serving no more to convey Blood, or an Alimental Liquor, to and fro, but Degenerating into a Ligament.

To the ſame Purpoſe with *this* Contrivance, we may mention that *other*, wherein Nature employs the

Foramen Ovale, that gives Paſſage to the Blood from the Right Ventricle of the Heart to the Left; that the Circulation of It may be maintain'd, tho' It cannot in the *Embryo,* as it does in a Born Child, paſs through the Veſſels of the Lungs from One of the Ventricles to the Other. For this *Formen Ovale* being but (if I may ſo call it) an *Expedient* that Nature Employs, as long as that which is Intended to be an *Infant*, remains an *Embryo*; this Temporary Conformation is Obliterated, when the Child Breathing the free Air, is in a Condition to make the Blood Circulate through the Pulmonick Veſſels, according to the Primary Intention of Nature. From which and the like Inſtances we may infer, That theſe Temporary Parts were Fram'd by a Forecaſting, as well as a Deſigning, Agent, who Intended they ſhould Serve for ſuch a Turn, and then be laid Aſide; it being utterly Improbable, that an Undeſigning Agent ſhould ſo Appoſitely and Exquiſitely Frame Scaffolds for the future Buildings, if he did not before-hand Deſtinate both the One and the Other, to concur to the ſame ultimate Effect.

Another Argument for our preſent purpoſe may be drawn, from the Conſideration of thoſe things that in Animals are commonly call'd *Inſtincts* ; whereof Some more directly regard the Welfare of the Individuals they belong to, Others the Propagation of their *Species*, and Some again reſpect both. The Writers of Voyages, and thoſe that profeſſedly deliver Natural Hiſtory, recount ſtrange, and ſcarce credible, Inſtances, of the Inſtincts obſervable in certain Animals. But we need not lay the ſtreſs of our Argument upon dubious, or ſuſpected Relations; ſince what I have met with in Authors of good Authority, or receiv'd from the mouths of Travellers of good Credit, may ſerve my preſent turn ; eſpecially if it be allow'd, (as I ſee not why it may not be,) to take the word *Inſtinct* in a latitude, ſo as to compriſe thoſe Untaught Shifts and Methods, that are made uſe of by ſome Animals, *to* ſhun or eſcape Dangers, or *to* provide for their future Neceſſities, or *to* catch their Preys.

Divers Strange Things are deliver'd, not only by Poets, but by more Credible Writers, about the wonderful Sagacity and Government of Bees, in point not only of Oeconomy, but of Politicks too. But tho' I ſhall not build any thing upon the Authorities that I my ſelf Suſpect, yet, having had the Curioſity to keep for a good while in my Cloſet a Tranſparent Hive, whence there was a free paſſage into a neighbouring Garden ; and having thereby had the opporunity to make frequent Obſervations of the Actions of theſe little Animals, and particularly to ſee them at work about making their Combs, and filling them with Honey: I confeſs I diſcover'd ſome things that I did not believe before, and was induc'd to look upon them as very fit Inſtances, of Creatures endow'd with natural Inſtincts and Providence. For 'twere hard for a Mathematician, in contriving ſo many Cells, as They make in the *Area* of one of their Combs, to husband ſo little ſpace more Skilfully, than They are wont to do. And not only They Carefully and Seaſonably lay up their Honey, to ſerve them all the Winter, but Curiouſly cloſe up the particular Cells with Covers of Wax, that keep the included Liquor from Spilling, and from External Injuries. I do not here mention the Prognoſtication of Weathers, that may be made in the morning by Their keeping within their Hives, or flying early abroad to furniſh themſelves with Wax or Honey, or by their unexpected Return before a Storm unforeſeen by Men; becauſe I ſuſpect that theſe things may not be ſo much the Effects of Inſtincts, as of a Tenderneſs and Quickneſs of Senſe, ſuch as may be ſeen in a good Weather-glaſs, and found in divers Wounded and Crazy Perſons, that are affected with ſuch Beginnings of the Changes of the Air, as are not yet perceiv'd by other men. But among the Peculiarities to be obſerv'd in the Conduct of Bees, I cannot but take notice, that after a Fight, I have, not without ſome wonder, ſeen them take up the Dead that lay on the Ground, and fly away wirh them to I know not what diſtance from their Hive.

Another obvious Inſtance of the Inſtinct that Nature has given even to ſome deſpicable Inſects, may be taken from Ants, to whom *Solomon* ſends the Sluggard to School, to learn the Providence of making Seaſonable Proviſion for the Future. For 'tis known, that theſe little Creatures do in the Summer Hoard up Grains of Corn againſt the Winter. And their Sagacity is the more Conſiderable, if it be true, what divers learned Perſons affirm, that they eat or bite off the *Germens* of the Grains of Corn they lay up, leaſt the Moiſture of the Earth expos'd to the Rains, ſhould make it Sprout. But whatever become of this Tradition, theſe Inſects do ſome other Actions, reſembling Sagacity and Induſtry, that are not ſo contemptible as their Bulk, tho' I muſt not ſtay to mention them particularly in this Place.

The Untaught Skill of Spiders, in Weaving their Curious Webs, that are ſo Fitly Contrived, both to Catch their Flying Prey, and give them immediate Notice of its being Caught, is a Thing, which, if it were not Familiar, would be look'd upon as Admirable. And this Skill is not, as Some Imagine, an Effect of Imitation of their Parents: For if the Eggs be taken away and enclos'd clos'd in a Glaſs, when they come to be Hatch'd by the Heat of the Sun, the little Creature will Immediately fall to Spinning in the Glaſs itſelf, as was related to me, by an Eminent Mathematician that made the Experiment. And I ſaw the leſs reaſon to Diſtruſt it, becauſe, having by an External Heat Hatch'd many Eggs of Silk-worms, in a Place where there had not been any of a long time before, nor probably ever till then, yet the Worms produc'd by theſe Eggs, did in Autumn, of their own accord, Climb up to thoſe convenient Places I had prepar'd for Them, and there Weave thoſe Curious Oval Priſons in which they encloſe themſelves, and which are Unrevel'd into Silk, of whoſe extreme Fineneſs or Slenderneſs I have elſewhere given an Account.

Nor is the provident Induſtry of Animals confin'd to Inſects, of whom the Poet, (if his words be taken in a Popular Sence,) truly ſaith;

Ingentes Animos anguſto in Pectore verſant.

Since 'tis to be found in divers of the Greater Animals, particularly in Beavers; of whom *tho'* Some things that are recounted by Authors and Travellers, are but Fabulous; *yet* what has been related to me by Sober and Judicious Perſons, that were either Born or Liv'd in *New England*, where theſe Animals abounding, they had the Opportunity to obſerve Them; is ſufficient to Confirm ſuch Relations, as may give One juſt Cauſe of Wonder. For theſe Credible Perſons affirm'd, *That* the Beavers with their ſharp Teeth, (whoſe Shape and Strength I have Admir'd,) Cut pieces of Wood ſo as to make them Fit for their Purpoſe: *That* by Aſſociating their Labours, they lay theſe together ſo as to Build themſelves Strong

Winter-houſes, in which there is ſometimes a kind of Second Story, for the Inhabitants to retire to, when the Water chances to Overflow: *That* for Theſe Houſes, they chuſe a very Convenient Situation, juſt by ſome River, or other Water, that can furniſh Them with Fiſh: And, *That* the Overture or Hole that belongs to each of theſe Houſes, is plac'd juſt by the Water, that they may immediately Flounce into It, and ſo Save themſelves when their Houſes are Attaqu'd. And to Facilitate their Swimming away, and the Catching of their Prey in the Waters, Nature has furniſh'd them, as I have Obſerv'd with pleaſure in a Live Beaver, with two Feet not made like Thoſe of *Dogs*, or *Cats*, or like their Own two Other Feet, but furniſh'd with broad Membranes betwixt the Toes, like the Feet of *Geeſe*, *Ducks*, and other Aquatick Animals, that are to uſe them as Oars, to Thruſt away the

Water, and Facilitate their Motions upon It, and in It.

'Twere eaſie to accumulate Inſtances of the Sagacity and Induſtry of Animals, for their own *Preſervation*: But 'tis more eaſie to find Notable Ones, among thoſe Actions that concern the *Propagation* of their *Species*.

The various Arts employ'd by Animals of differing Kinds about the Materials, the Conſtruction, and the Situation of their Neſts, is uſually Remarkable, and ſometimes Wonderful. Of this Skill, we have divers Eminent Inſtances, ſome of which I have been delighted to See, but have not time to Recount. Yet One there is, whoſe Oddneſs will not ſuffer me to pretermit it. For in a Country that abounds with Apes and Monkeys, that are very Greedy of Birds Eggs, and oftentimes Climb Trees to come at Them; there is a Sort of Birds, whoſe Eggs they peculiarly affect, that do as it were Hang their Neſts at or near the end of ſome long Flexible Branch or Wand, that grows Over the Water; by which means their Inſidious Enemies, who do not Swim, cannot come at them Underneath; and by reaſon of the Yielding of the Flexible Branch or Twigs whereto the Neſt is faſtened, they are Frighted from venturing to paſs on, for want of a Firm Support.

The Structure of the Neſts of Waſps, which they often make under Ground to Secure them, I have obſerv'd to be very Curious and Artificial, eſpecially when the Young Ones are Form'd in the little Cells, where they lye Hid and Shelter'd till they are ready to Fly away.

I might here multiply Examples of this Kind, but I think it fitter to proceed, by telling you, That the

Inſtincts that Nature has Implanted in Animals to Preſerve themſelves, tho' they would ſeem Admirable if they were leſs Familiar, are much Infetiour to That Providence that She has furniſh'd Animals with, for the Propagation of their *Species*.

There are diverſe Notable Things to be met with in the Neſts of ſeve- Birds, both as to their Materials, their Structure, and the very Situations of the Places pitch'd upon to Build them in. I have ſeen ſome Neſts, eſpecially *Indian* Ones, which would make a Man Wonder, how the Birds that Built them, ſhould ſeek and find ſuch Odd, and yet, all Circumſtances conſider'd, Commodious Materials to Build with. Of which we have an Eminent Inſtance in the Neſts of certain *Eaſtern* Birds, whoſe Names I remember not, that make their Neſts of a White Subſtance, (which has been Preſented me by ſome of our *Eaſt-India* Merchants,) that looks almoſt like *Icthyocolla*, in the Shops commonly call'd *Iſinglaſs*, and is Diſſoluble in Liquors, and ſo very well Taſted, that it makes the chief Sawce that they uſe in the *Southern* Parts of *India* at their Feaſts. The Structure alſo of the Neſts of divers Birds, both as to their Figure, their Capacity ſuitable to the Bulk of the Builders, and the Accommodations they are furniſh'd with for Warmth and Softneſs, may deſerve to be Applauded by Mathematicians themſelves: eſpecially if it be conſider'd, that theſe little Untaught Architects had no Tools to make their Curious Buildings with, ſave their Beaks and their Feet. And yet much more of Providence and Foreſight appears in the Situation of the Places, that ſome Birds make Choice of to Build their Neſts in: As may be obſerv'd, not only in the Pendulous Neſts of Swallows, and the Crafty Hidden Ones of ſome *European* Birds, but very conſpicuouſly in the Hanging and

Moveable Neſts, that we lately mention'd to be ſo Oddly plac'd by ſome Birds, to ſecure their Eggs from Apes and Monkeys ; and by the Situation of the well Taſted Neſts I was newly ſpeaking of, which are to be found only upon high and ſteep Rocks, and are *ſo* faſtned to thoſe Concave Parts of them that look downwards, and, for the moſt part, hang directly over the Sea, *that* there is no getting Them without much Trouble and Danger, by the help of Boats and Poles : Upon which Account, as well as That of their Deliciouſneſs, they are very Dear in the *East Indies* themſelves. The like Care to Contrive their Neſts Advantageouſly, and make them in Secure Places, is taken by divers Inſects themſelves, as may be obſerv'd in the Subterraneal Neſts of the Waſps formerly mentioned, and in the Eggs of Snails, which I have ſometimes found Hid under Ground, and had the Curioſity to Hatch in Glaſſes furniſh'd with the ſame Earth they were found in.

If I ſhould here reckon up and diſplay the ſeveral Effects, and conſequently Arguments, of the Wonderful Providence, that the moſt Wiſe Author of Nature exerciſes about the Propagation of Animals, *by* diſtinguiſhing them into Male and Female: *By* furniſhing both Sexes with Mutual Appetites and Organs, exquiſitely adapted to the Increaſe of their Kind: *By* the admirable Formation of the *Fœtus* in the Womb, without the Females Knowledge How it is perform'd: *By* the ſtrange Subtilties and Courage that Several of them, either Oviparous or Viviparous, have, to Hide and Defend their Young: *By* the full Proviſion that is made for the Nouriſhment of the *Fœtus*, and the Welfare of the Female after She has brought It forth: And *by* divers other Ways that I muſt not now ſtay to ſpecifie. If, I ſay, I ſhould venture to do this, I might indeed, much enrich and adorn my Argument, but ſhould make this Diſcourſe too much exceed the Limits that my Deſign, and ſmall Stock either of Ability or Leiſure, would allow. And therefore, inſtead of purſuing a Speculation, that would lead me a great deal too far, I ſhall look back upon the Intimation I gave not long ſince, that even thoſe Meaner Parts of Animals which ſeem to have been Fram'd with the leaſt Care or Contrivance, are yet not Unworthy of their Author.

For Proof of which, I ſhall now obſerve, That *tho'* the Teeth be ſome of the leaſt Elaborate Parts of the Humane Body; *yet* even Theſe afford more Obſervations appliable to our preſent Purpoſe, than my Intended Brevity will permit me to take Notice of. And therefore I ſhall only, and that little more than tranſiently, conſider a few of Them here ; and ſome of the Others elſewhere, on thoſe particular Occaſions, on which it will be more Proper to bring them in.

I. And Firſt, 'Tis conſiderable, That whereas, when a Man is come to his full Stature, all the Other Bones of the Body ceaſe to Grow, the Teeth continue to Grow in Length, during a Man's whole Life.

This Growth of the Teeth appears, not only by their Continuing ſo many Years of the Same Length, but by the Unſightly Length of One Tooth, when That which was oppoſite to It in the other Jaw happening to Fall out or be Pulld out, the Tooth we ſpeak of has liberty, to Grow into the Gap made by the Removal of the Other. Of this Difference in point of Growth betwixt the Teeth and other Bones, What Reaſon can be ſo probably given, as, That 'tis deſign'd to repair the Waſte that is daily made of the

Subſtance of the Teeth, by the frequent Atritions that are made, between the upper and lower Tyre, in Maſtication?

II. Whereas the Other Bones of the Body (ſome few Small Ones excepted) are Inveſted with a very thin and ſenſible Membrane, which, for its cloſe adheſion to the Bone, is by Anatomiſts call'd the *Perioſteum*: That Part of each Tooth which is not cover'd by the Gums, has none of this Membrane, which would be ſubject to frequent and very painful Compreſſions and Lacerations.

III. To enable the Teeth to Break, and make Comminutions of the more Solid kind of Aliments, Nature has providently Fram'd them of a Cloſer and Harder Subſtance, than almoſt any other Bones of the whole Body; tho' theſe be ſo Numerous, that Anatomiſts reckon above Three Hundred of them. And I have met with Relations in

Authors of good Credit, That Some Men's Teeth have been ſo Hard, as, when ſtruck with another Fit Body, to produce Sparks of Fire.

IV. That Theſe Bones, whoſe Uſe (to Prepare Aliments for Nutrition) is ſo Great, and almoſt Neceſſary, may themſelves be continually Fed and Cheriſh'd, tho' they Grow in Other Bones; the All-wiſe Author of Things has admirably Contriv'd an Unſeen Cavity in each ſide of the Jaw-bone, in which Greater Channel are lodg'd an Artery, a Vein, and a Nerve, which thorough Leſſer Cavities, or as it were Gutters, ſend their Twigs to each particular Tooth; which by Theſe little Veſſels that reach to It, receives a continual Supply of Nouriſhment and Strength.

V. In regard that Babes are, according to Nature's Inſtitution, to Feed for a conſiderable time on Milk, for which there is no need of Teeth, and which would alſo Hurt the Nipples of Her that gives them Suck: Nature forbears for many Months to produce Teeth in Humane Infants: whereas the *Fœtus*'s of divers Brute Animals, that are oftentimes reduc'd Early to ſeek out Aliments that are not Fluid, nor very Soft, are Born with Teeth already Form'd in their Jaws.

VI. The Bony Subſtance appointed for the Comminution of Aliments, ought not for ſeveral Reaſons, (which for Brevity's ſake I here omit,) to be in either Jaw Entire, or all of one Piece: And therefore Nature has providently made for that Uſe, a competent Number of diſtinct Bones in either Jaw. And, becauſe Men may often have Occaſion, to feed upon very differing Sorts of Aliments, and uſually the Same Aliment may require Differing Preparations in the Mouth, to Facilitate the Digeſtion of It in the Stomach: Nature has provided Men with Two Rows or Sets of Teeth, equal for the moſt part in Number, (each Jaw in Men uſually having Sixteen, and in Women Fourteen or Fifteen,) and anſwering to each other, but yet of differing Shapes, for differing Uſes. For Some, as the Fore-teeth, are Broader, and with a kind of Edge, to Cut the more Yielding Sort of Aliments; whence theſe Teeth are called *Inciſorii.* Others are Stronger, and more fitly Shap'd to Tear the more Tough and Reſiſting Sort of Aliments: Theſe are They that by the Vulgar are in *Engliſh* call'd *Eye-Teeth*, and which, for their Reſemblance to Thoſe of Dogs, are by Anatomiſts calld *Canini.* And then there is a Third Sort, whoſe principal Office is to Grind the Aliments that are Cut or Torn by the Others ; and for this Purpoſe they are made much Broader, and ſomewhat Flattiſh , but yet with their Upper Surfaces Uneven and Rugged, that by their

Knobs and little Cavities, they may the better Retain, Grind and Commixe the Aliments, that are to be Chew'd by Them: And for this Reaſon they are call'd *Molares*.

VII. And becauſe the Operations to be perform'd by the Teeth, oftentimes require a conſiderable Firmneſs and Strength, *partly* in the Teeth themſelves, and *partly* in the Inſtruments that Move the Jaw wherein the Lower Set of them is fix'd: Nature *has* provided the Lower Jaw, (which alone is Moveable, unleſs, as Some affirm, in *Crocodiles*,) with Strong Muſcles, to make it bear forcibly againſt the Upper Jaw: And *has* not only Plac'd each Tooth in a diſtinct Cavity of the Jaw-bone, as it were in a Cloſe, Strong, and Deep Socket, but *has* furniſh'd the ſeveral Sorts of Teeth with Hold-faſts, ſuitable to the Streſs, that, by reaſon of their Differing Offices, they are to be put to. And therefore, whereas the Other Teeth (the Cutters and the Dog-teeth) have uſually but One Root, (which in theſe laſt nam'd is wont to be very Long;) the Grinders, that on many Occaſions are employed to Crack Nuts, Bones, or Other Hard Bodies, before they can be Ground; are furniſh'd with Three Roots, and oftentimes with Four, in the Upper Jaw, whoſe Subſtance is ſomewhat Softer, and whoſe Grinders Serve as ſo many little Anvils, for Thoſe of the Lower to Strike or Preſs againſt. On which Account, as hath been already Intimated, the Lower Jaw, (for the Other belongs to the Immoveable Part of the Skull,) is furniſh'd with a ſtrong Muſcle on either ſide, capable of Moving It, and conſequently the Teeth in It, with great Force againſt the Upper Jaw.

If ſome Favourer of *Epicurus*'s Doctrine ſhall here Object, that, *tho'* Man indeed be Advantagiouſly furniſh'd with Teeth, *yet* there are many Other Animals, and even Quadrupeds, whereof ſome have not near ſo Many Teeth as Man, nor ſo Commodiouſly Shap'd and Plac'd as His; and Others are not furniſh'd with any Teeth at all: And that likewiſe there are many Other Animals, that have ſome of their Other Parts leſs Convenient in their Kind, or otherwiſe are not near ſo well provided for, as they would be, if they were not rather Caſual Productions, than thoſe of an Intelligent and Deſigning Opificer: If Theſe things, I ſay, be Objected, I muſt own myſelf of a very differing Opinion from the Objector. And I think I could add much about the *Final Cauſes* of Things Corporeal, as the Conſideration of them leads to a high Veneration of their Divine Author, and as it tends to manifeſt, that, when His Providence is Deny'd or Condemn'd, 'tis for want of Its having been ſufficiently Underſtood, and duely Conſider'd. But, beſides that this Third Propoſition ought to be but One Part of our Diſcourſe of *Final Cauſes* ; I have in great Part prevented myſelf already, by what I have formerly ſaid, to Obviate or Anſwer ſome Exceptions, relating to the Eyes of Man, and Differing Animals. For Moſt of the Conſiderations, if not All, that have been Alledg'd on the Occaſion of thoſe Organs of Sight, may well be, *Mutatis Mutandis*, applied to the Varieties that are to be found in the Teeth, and other Parts, of differing Kinds of Animals. For I may juſtly repreſent, That the Reaſon why This or That Organical Part of This or That *Species* of Living Creatures, has not ſuch a Structure, or is not ſo Plac'd, as We might think moſt convenient, may often be, That in this Caſe it would be leſs proper for Other Ends, of more Importance to the Welfare of the Animal, than ſuch a Fabrick and Situation of the Part as We Prefer, would be. And there are alſo many Caſes, wherein the Thing that We make bold to think Wanting or Amiſs, is provided for by Other Contrivances in the Same Animal; by which Proviſion, the Part under Conſideration is made more Serviceable and Symmetrical to the reſt of the Body: And ſo, performing Other Offices beſide the Main, is, upon the whole Matter, more Uſeful to the Animal, than Otherwiſe it would be.

'Tis known that Oxen and Sheep, and many Other Ruminating Beaſts, are not furniſh'd with near ſo many Teeth as Men are, and as are to be found in *Dogs*, *Cats*, *Horſes*, and many other Quadrupeds. But for the Paucity of Teeth Amends is made, in moſt of thoſe Animals, *partly*, by the Power and Inſtinct They have to Chew the Cud, and thereby make a Second Attrition of their already much Softned Aliments; and *partly*, by the Succeſſive Cavities or Stomachs, (diſtinguiſh'd by the Names of *Primus*, *Venter*, *Reti-*

Reticulum, *Omaſus* and *Abomaſus*,) through which the Aliment is Tranſmitted, and more and more Elaborated, to make it Fit for further Uſes. The Mouths (eſpecially the Inward Parts of them,) of the *Beaver*, the *Tortoiſe*, the *Bee*, the Humming Bird that Feeds on Flowers, whoſe Exudations with his long little Bill He Sucks like the *Bee*: Theſe, I ſay, and many Other Animals, (to omit the Elephant himſelf,) have their Mouth, and their Ways of Preparing their Aliments for the Stomach, very Different from what is obſerv'd in Men, and yet very Convenient for them reſpectively, all Circumſtances conſider'd.

Theſe and the like, whether Compenſations or Expedients, are in many Animals ſuch, that there is no Cauſe to tax the Author of Nature, for not having given Some Animals, all the ſame Parts that Others are furniſh'd with: But rather the

Thrifty Providence, (if I may ſo ſpeak,) and Deſigning Wiſdom of God, in the Contrivance of his Viſible Works, may be as well diſcover'd *by* the ſeeming Omiſſion of This or That Part, that is Uſeful to Other Animals, but is not Neceſſary to Thoſe wherin it is not found, as, *by* Granting Thoſe Parts to the Animals, to whoſe Compleatneſs or Welfare they are Neceſſary, or highly Conducive. On which account 'tis not to be thought Strange, that He has not to Men, as to Frogs, and many ſorts of Birds, given ſuch Tough, Tranſparent, and Moveable Membranes, as theſe Animals are provided of to Cover their Eyes, from Harms that Thoſe of Men are not uſually expos'd to. And 'tis not an Omiſſion, not to have given Girls Swelling Breaſts, before they are capable of Generation, more than 'tis, not to continue to them, after their being grown Mothers, the *Placenta Uterina*, when they are not with Child.

Though *Batts* be look'd upon as a Contemptible ſort of Creatures, yet I think they may afford Us no Contemptible Argument to Our preſent Purpoſe. For in this Heteroclite Animal, you may diſcern the Fœcundity of the Divine Artificers Skill, which has in this Form'd an Animal that Flies like Birds, and yet is not only Unfurniſh'd with Feathers, but is of a Fabrick quite differing from that of Other Birds. And in this little Animal We may alſo obſerve, *both* the Compenſation that is made for Parts, that ſeem either Deficient, or leſs Advantag'd than Thoſe of the ſame Denomination in Other Birds: *and* the Regard, which the Divine Artiſt appears to have to the Symmetry of Parts, in His Animated Works, and to their Fitneſs for the Places they are to Live in or Frequent. For the *Batt*, being to act ſometimes like a Bird, that Flies freely to and fro in the Air, and on ſome Occaſions like a Terreſtrial

Animal, ſuch as is that little Quadruped a *Mouſe* ; ought to be furniſh'd with Parts ſuitable to ſuch Differing Deſtinations. And therefore, to fit him to Anſwer the Firſt of Theſe, the want of Feathers in the Wings is ſupply'd by a broad Membranous Expanſion, and a kind of Toes furniſh'd with Articulations, that make up the Wings: And, becauſe this Animal was to be able, like Other Birds, to forbear Settling on the Ground, otherwiſe than his Occaſions requir'd: Each of his Wings is furniſh'd with a ſtrong Crook, like the Claw of a Bird's Foot, by the Help of which he can faſten himſelf to Trees, Walls, and divers Other Erected Bodies, and keep himſelf Suſpended in the Air, and continue at what Diſtances he pleaſes from the Ground. And becauſe he is furniſht with *Teeth*, which other Birds want, to Chew his Food, and thereby prepare it for Digeſtion: He needs not have a Crop, or ſuch a Strong and

Muſcular Stomach, as is uſually found in Birds: And (in ſhort) to Omit the peculiar Structure of Other Internal Parts, wherein the *Batt* differs from Other Birds: Since the Female was not, like Them, to be Oviparous, but, like *Mice* and Other Quadrupeds, that bring forth their Young Ones alive: She is not only furniſh'd with an *Uterus* fitted for that Purpoſe, but, in regard She does not, like Birds that lay Eggs, Exclude, together with the *Fœtus*, a competent Stock of Aliment to Nouriſh It, till it can Shift for Itſelf: The *Batt* is furniſh'd with Dugs, to give Suck to her Young Ones: And by Zoographers 'tis obſerv'd, That, *as* ſhe has but Two Teats, *ſo* ſhe brings forth but Two Young Ones at a Birth; whereas *Mice* are much more Prolifick.

The Writings of Zoographers, and the Relations of Travellers, afford divers other Inſtances of the

Various, and yet Excellent, Contrivances, that are to be found in ſeveral Animals that differ from Man, (who is an Animal endow'd with numerous Teeth,) in the Fabrick of the Mouth, and Other Parts inſervient to the Reception of Aliments, and their Preparation for Digeſtion.

But paſſing by the Mouths of Tortoiſes, Camelions, and Other Animals, the Hardneſs of whoſe Gums, in reference to their Ordinary Aliments, ſuffices to make Amends for their Want of Teeth. There is one *American* Beaſt, which I think, I ought not to forbear mentioning here, as a Notable Inſtance, to manifeſt how the Wiſe Architect can Compenſate the Want of Teeth, by the rare Structure of the Mouth and Tongue, and Their Fitneſs to Seize on and make Uſe of thoſe Aliments, which, tho' Uncommon for a Beaſt of His Bulk, He ſeems to have been deſtinated to Live upon. The Animals of this Kind are by *Hernandus*, who retains their *American* Names, call'd *Achoas* and *Tamendoas*; and of Theſe, and particularly of the Parts they are provided of to Eat with, he gives us this Account. *Vid. Schotti Phyſ. Curioſ. l. 8. c. 5.* *Offenduntur apud Yucatenſes Quadrupedes quidam, dorſo prædaro & fulvi, agnorum magnitudine, ſed qui ventre circiter Terram attingant, dentium omnino expertes ſint, & ſolo formicarum venatu vivant, quarum cumulos duobus magnis unguibus quibus ſinguli anteriores pedes armantur, excavant turbantque; ac dein exerta lingua, quæ dotranto longior eſt, ſcabra tores ac pennam anſerinam craſſa, formicas eam conſcendentes ac denſantes ſuſcipiunt, eademque contracta, & in os, quod mirum in modum anguſtum ac parvum eſt, recepta, gratum ſibi pabulum capiunt, & innocentium Animalium præda potiuntur.* Of the ſame ſort of Beaſts, the Ingenious *Piſo*, in his *Hiſt.* of *Braſile*,(where he Practis'd Phyſick)mentions Two kinds, the Greater and the Leſs, which He, like *Hernandus*, calls *Tamanduas*, but adds the new coin'd Name of *Myrmecophaga*; and of Both gives this Account. *Vtræque* (ſays he) *ſunt noctambulæ pabuli cauſa; Cicuratæ carne quoque veſcuntur, ſed minutim conciſa quia non ſolum capite, promuſcide, ſed & ore ſunt anguſto, accuminato, edentuloque, lingua denique, inſtar chraſſioris Chordæ, tereti adeoque longa præſertim: in Tamandua majori, ut duorum pedum longitudinem excedat, atque proinde duplicata (quod notatu ſane dignum) quaſi canali incumbit inter inferiores genas, quam eſuriens madidam exerit, & arborum truncis diu imponit, mox formicis opertam repente retrahit. Si alte fodiendo latebræ earum detegi poſtulant, Vnguibus id præſtat commode, quibus pedes poſteriores inſtructi ſunt ſatis validis & longis numero quinque, anteriores quatuor, iiſque re-*

Gulielmus Piſo l. 5. Hiſt. Nat. & Med. c.22.

curvis, duobus in medio maximis.

'Tis alſo to be conſider'd, That Divers Things may be Uſeful in an Organical Part, beſides That whereby its Function is primarily and mainly exercis'd: As, *tho'* the Eye-lids and their Motions, together with the little Glandules that belong to them (moſt of which lye conceal'd under the Edges) *are not* at all neceſſary to the Act of Viſion, (no more than Curtains are to a Window;) *yet* they *are* to the Compleatneſs and Welfare of the Eye, which is the neceſſary Organ of Viſion: As is manifeſt by the Pain and Prejudice the Eye receives, if the Eye-lids, which are ſubject to more than One Diſtemper, be conſiderably Diſaffected.

I may hereafter have occaſion to take notice, that, beſides thoſe Uſes of the Parts of a Human Body, which I venture to call *Anatomical*, becauſe they are ſuch as Anatomiſts have diſcover'd by meer Diſſections; there may be of ſeveral Parts Other Uſes, which I call *Chymical*, becauſe Theſe Parts do Elaborate Spirits of ſeveral Sorts, and perhaps Exerciſe ſome other Spagyrical Functions of great Importance, if not of Neceſſity to the Welfare of a Living Man.

And, beſides, the Anatomical and Chymical Uſes, there may be others very fit to be conſider'd in ſome parts of a Human Body; as the *Mechanical* Advantages, for which the Various Shapes and Structures of differing Muſcles, and the ſeeming Irregular, and as it 'twere Caſual Fabrick of the Bones, and eſpecially of the Proceſſes and Protuberances, are admirably Fitted. And there are alſo in ſome Parts, as the Eyes, *Optical* Reaſons to be conſider'd, before One can otherwiſe than Raſhly Cenſure, what the Author of Nature has done about them: As, tho' the figure of the

Chryſtalline Humour be much more Globous in moſt Fiſhes, than in Men and Tereſtrial Animals, yet he that underſtands the Doctrine of Refractions, and conſiders that Fiſhes under Water are to ſee Objects through a far thicker *Medium* than Air, will readily acknowledge, that this Difference between the Eyes of Fiſhes and thoſe of Men, is not an Imperfection in the former; but whilſt thoſe Creatures are in their own Element, a great Advantage. And, to be ſhort, I think there are ſo many Sciences, and other Parts of Knowledge, ſome of them perhaps ſcarce yet Diſcover'd, that may be required to warrant a man, to Cenſure the Ends of God in the Bodies of Animals, that very Few have Knowledge enough to be capable of Condemning them without Raſhneſs: And they that have Knowledge enough to Judge aright, will not be forward to Condemn them, but Admire them. But, *tho'* this Conſideration be not here diſplay'd, yet the now mention'd Intimation of it may afford us this Reflexion, That Men may eaſily be too Raſh, if they think a part Bunglingly Fram'd, upon Suppoſition that, by the Anatomical Inſpection of it, they know all the Uſes that the Skill of the Divine Opificer could Deſign it for.

Nor will it neceſſarily follow, that, becauſe in ſome Particular Bird, or Beaſt, or Fiſh, we may not be able to give an account, Why this or that Part is not to be found, or Why it is otherwiſe Fram'd or Situated than that which is Analogous to it in Man; it muſt therefore be Caſually or Improvidently Fram'd or Plac'd: Since we cannot expect from Brute Animals, Anſwers to thoſe proper Queſtions about their own Bodies, which we can receive from Men about their Human Ones. And yet, notwithſtanding the great Aſſiduity, with which the more curious Phyſicians are oblig'd to Cultivate Anatomy, and the frequent Opportunities they have to do it, and to ask Living Men Queſtions about what they find, when the Natural Uſe of their Parts is Hindred or Perverted: Our Sagacious Moderns are to this day at a Loſs, as to the True Uſes of the Viſible Parts of the Body; to ſay nothing of the Inviſible, ſuch as Spirits, Salts, *&c.* So that it ought to be no Wonder, if in Animals, whoſe Fabrick we have much leſs Concern to Inquire into, and and much leſs Opportunity to Examine, we ſometimes find Parts, of whoſe Uſes and their Fitneſs for them, Men are not yet able to give a ſatisfactory Account. For I conſider, *that* even in Man himſelf, tho' there be numerous Valves found in his Veins, yet for thoſe many Ages that the True Uſes of them lay Hid, an *Aſclepiades*, or ſome Other bold *Epicurean Phyſician*, might have thought himſelf well grounded, to look upon them as Superfluous Parts: Which, now that the Circulation of the Blood is diſcover'd, they are ackowledg'd to be far from being.

On this Occaſion it may help us if it be conſider'd, That, ſince God is both a moſt Free and a moſt Wiſe Agent, it need not ſeem Strange that He ſhould Adorn ſome Animals, with Parts or Qualities that are not Neceſſary to their Welfare, but ſeem'd Deſign'd for their Beauty: Such as are the Diſpoſition of the *Camelion* to Change Colours; and the lovely Greens, Blews, Yellows, and Other Vivid Colours, that Adorn ſome ſorts of Pigeons, and of Parrots, and divers Leſſer Birds, as Gold-finches, Canary-Birds, and eſpecially thoſe admirably little Winged Creatures Humming Birds. And on the Other ſide, ſometimes God's Wiſdom ſeems to be as it were Thrifty, and Solicitous not to beſtow on an Animal, or a Part of it, more than is Neceſſary for the Uſe for which 'tis Deſign'd. As the Veins are by Anatomiſts obſerv'd to have but One Coat or Membrane, and uſually to lye more Expos'd than the Arteries that accompany them; Theſe having Stronger and Double Coats, becauſe they are to convey a more Important Liquor, (the Arterial Blood,) which beſides that 'tis more Agitated and Spirituous, is forcibly impell'd into Thoſe Veſſels by the Muſcular Contraction, or Strong Impulſe of the Heart. And to the ſame purpoſe it may be obſerv'd, That the Arteries within the Skull are far more Thinly Coated than elſewhere; the Solidity of that Bony Part being a Fence to the Veſſels that it covers. And to add That on This Occaſion, we may obſerve, That, *tho'* the Nerves uſually lye Deep in the Parts, to be kept both Safe and Warm, being very lyable to be offended both by Cold, and the Contact of External Bodies; *yet*, it being neceſſary that the Optick Nerve ſhould Expand itſelf into the Eye, the Membranes that Inveſt the Nerve and Other Coats of the Eye, (except the *Retina*, which ſeems to conſiſt of the Medullar Fibres,) are made by great Odds more Firm than the *Dura* and the *Pia Mater*, whence they proceed; and tho' Expos'd to the Free Air, are leſs ſenſible of the Cold than moſt Parts of the Body, and will bear, without Danger, divers Liquors, and Other Offenſive Things, whoſe Pungency would put Other Nerves of the Body into Convulſive, and perhaps very Dangerous Motions. This (Conduct) looks as if God, like an Excellent Writing-Maſter, did, in the great Volume of his Creatures, Intend *to* beſtow on ſome of Theſe, Things rather Ornamental than Neceſſary, as Flouriſhes on the Capital Letters of the Alphabet of Nature; and ſometimes, *to* Imploy Characters, and divers of them very differingly Shap'd, (as the

Latin are from thoſe of the *Greek*, the *Hebrew*, the *Saxon*, &c.) to Expreſs the Same Letter ; and ſometimes alſo, *to* Imply Abbreviations, as a Stroke or a Daſh, inſtead of a Letter or a Syllable, to Expreſs Compendiouſly that which might be very Juſtifiable, had it been more Fully ſet down or Delineated.

If That be admitted, which We have formerly propos'd as very Likely, that God Deſign'd, by the great Variety of His Works, to Diſplay to their Intelligent Conſiderers, the Fæcundity (if I may ſo ſpeak) of His Wiſdom ; One may readily conceive, that a great part of the Variety Obſervable in the Analogous Parts of Animals, as their Eyes, their Mouths, *&c.* may be very Conducive to ſo Reaching and Comprehenſive a Deſign ; to which the Beauty of ſome Creatures and Parts, as well as their more Neceſſary or Convenient Structure, may be ſubſervient; eſpecially if the Innocent Delight of Man be alſo Intended, as it may ſeem to be in the Curious Colours and Shapes of divers Flowers, and in the Melodious Muſick of Singing Birds, and in the Vivid and Curiouſly Variegated Colours of the Feathers of ſeveral Winged Animals, particularly thoſe that make up the Peacocks Train.

We are not near ſo Competent Judges of Wiſdom, as we are of Juſtice and Veracity: For Theſe laſt named are to be Eſtimated by Eternal and Fixed Bounds or Rules, which are very Intelligible to a Moderate Underſtanding. But as for Wiſdom; the more Profound it is, the leſs we are able to Look through it, and penetrating to the bottom of that, to Judge knowingly of its Actions. And therefore, *tho'* we may ſafely Conclude that God Acts Wiſely, when he does ſomething that has an Admirable Tendency to thoſe Ends we juſtly ſuppoſe him to have Deſign'd; *yet* we cannot ſafely conclude in a Negative way, That this or that is Unwiſe, becauſe we cannot Diſcern in it ſuch a Tendency. For ſo Wiſe an Agent may have Other Deſigns than we know of, and further Aims than we can Diſcern, or perhaps Suſpect: And may have at hand, or furniſh himſelf with, ſuch Means to compaſs his Ends, and that even by the Co-operation of thoſe Means we think Uſeleſs or Improper, as are far above the reach of our Conjectures, and without the knowledge of which we but Raſhly Cenſure the Wiſdom of his Proceedings.

In the Double Horizontal Dial formerly mention'd, it would be Raſhly done of thoſe, who ſhould Condemn or Deſpiſe the various Lines they find trac'd upon that uſeful Inſtrument, becauſe they ſee that they are not neceſſary to ſhew the Hour of the day; ſince the Mathemathematician that drew thoſe Lines ſo curiouſly, may be well ſuppos'd to have had more Ends than One or Two in making the Inſtrument, and not to have drawn them by Chance or Unskilfully; tho' the Inconſiderate Cenſurers do not know, for what Other or Further Purpoſes the Artiſt may have Deſign'd them.

Suppoſe ſome Indian Fiſherman, unacquainted with European Arts and Affairs, ſhould happen to come aboard a Man of War under Sail: Tho' he would quickly perceive by the uſe that was made of the Ropes, Pulley, *&c.* that this. Floating Building was very artificially Contriv'd: Yet if he ſhould fix his Eyes upon one of the Guns, and the Anchors, and perceive that no uſe was made nor like to be made of them in Sailing, He would be ſtrongly tempted to think, that thoſe heavy Maſſes were uſeleſs Clogs and Burdens to the Veſſel. But if he were told the Neceſſity and Uſefulneſs

fulneſs of the Guns for Defence, and of the Anchors to ſtay the Ship in Convenient Places in Storms; he would eaſily Alter his mind, and Confeſs, that he Blam'd the Builders and Furniſhers of the Ship, for That which nothing but his Ignorance kept him from highly Commending.

I have dwelt much longer than I intended on this Third Propoſition, becauſe I think it a Duty our Reaſon owes to its Author, to endeavour to Vindicate his manifold Wiſdom, in this Libertine Age; wherein too many Men, that have more Wit than Philoſophy or Piety, have upon Epicurean, and ſome alſo even upon Carteſian, Principles, labour'd to Depreciate the Wiſdom of God, and ſome of them preſum'd to Cenſure the Contrivances of theſe living *Automata*, that (in their Protoplaſts) were Originally His. And it was not only the Seaſonableneſs of ſaying, about ſo Important a Subject, ſomethings that poſſibly have not yet been met with, or at leaſt duly Conſider'd, That has made me thus Prolix; but a Deſire, that my Reader ſhould not barely obſerve the Wiſdom of God, but be in ſome meaſure Affectively Convinc'd of it. To which purpoſe in my Opinion, 'tis very Conducive, if not Neceſſary, beſides General Notions, to obſerve with Attention ſome Particular Inſtances of the Divine Skill, wherein it is Conſpicuouſly Diſplay'd. 'Tis true, that in the *Idea* of a Being Infinitely Perfect, Boundleſs Wiſdom is One of the Attributes that is Included. But for my part, I ſhall take leave to think, that this General and Indefinite *Idea* of the Divine Wiſdom, will not give us ſo great a Wonder and Veneration for it, as may be produc'd in our minds, by Knowing and Conſidering the Admirable Contrivance of the Particular Productions of that Immenſe Wiſdom,

dom, and their Exquiſite Fitneſs for thoſe Ends and Uſes, to which they appear to have been Deſtinated.

PROP. IV.

That we be not Over haſty in Concluding, nor too Poſitive in Aſſerting, that This or That muſt be, or is, the particular Deſtinated Uſe of ſuch a Thing, or the Motive that induc'd the Author of Nature to Frame it thus.

IT has been above declar'd, That ſome Parts are *ſo* Excellently, and *ſo* Manifeſtly, Fitted for a certain Uſe, as the Eye for Seeing; and *ſo* much better Fitted for That, than for any Other; *that* 'twere little leſs than Heedleſsneſs or Perverſeneſs, to Doubt of Its being

Deſtinated Thereto. But the like cannot be ſaid of all the Other Parts of the Body, eſpecially of the Internal. And there are divers Uſes, either Neceſſary, or highly Conducive, to the Welfare of the Animal, to which no One Part is ſo much more conſpicuouſly Fitted than any Other, but that 'tis more Difficult than many think, to determine the True and Primary Uſes or Offices of ſome Parts, eſpecially with ſo much Certainty, as thereon to ground Phyſiological Inferences : And of this Difficulty I conceive there may be *four Reaſons*, tho' they do not All, nor perhaps Moſt of them, occurr in Each particular Caſe.

And *Firſt*, the whole Animal it ſelf, the Uſe of whoſe particular Parts is under inquiry, is but a Part of that greater Body, the *Univerſe*; and therefore cannot eaſily be ſuppos'd, to have been fram'd and furniſh'd with the Parts it conſiſts of,

meerly

meerly for its own ſake. And when we ſay, that all its Parts are Contriv'd for the beſt Advantage for the Animal, I conceive it is to be underſtood in this Limited Senſe; That the Parts are excellently fram'd for the Welfare of the Animal, as far forth as That Welfare is conſiſtent with the General Ends of the Author of Nature, in the Conſtitution and Government of the Univerſe: which *Ends*, becauſe they relate to the whole World, or to very conſiderable Maſſes of it, as the Terraqueous Globe, the Planets, and other Stars, I have formerly, for brevity's ſake, ſtyl'd *Coſmical*: And *tho'* it has not been prov'd, that None of theſe *Coſmical* Ends are inveſtigable by us: *yet* to diſcover them All, is not an eaſie Task. And yet it ſeems preſumptuous to ſuppoſe, that the Welfare of particular Animals is any further deſign'd and provided for, than will conſiſt with the *Coſmical* Ends of the Univerſe, and the Courſe of

Gods General Providence ; to which his Special or Particular Providence, about this or that meer Animal, ought in reaſon to be Subordinated. And *tho'* I think it a great Raſhneſs for us men to Determine poſitively, and *excluſively to others*, what Ends the Omniſcient Creator propos'd to himſelf, in giving to the World the Frame we ſee it has ; *yet*, as far as I can hitherto diſcern, I ſee nothing that is *more* likely to have been One Grand Motive of ſo great a Variety as we may obſerve in his Corporeal Works, eſpecially in Animals, *than* that which hath in part been elſewhere intimated, *viz.* That He might, by ſo many and ſo very differing Contrivances, as are to be met with in the Structure of Men, Four-footed Beaſts, Birds, Fiſhes, Reptiles, *&c.* Exerciſe and Diſplay (what could not be by a leſs Variety ſo fully manifeſted) that which an *Apoſtle*, ſpeaking of things of ano- Epheſ. 3. 10.

ther Order, Emphatically ſtyles the πολυ-ποίκιλος σοφία τοῦ Θεοῦ (*the Multifarious or Manifold Wiſdom of God.*) Man being acknowledg'd, upon the account of his very Body, the moſt Perfect of Animals; if God had ſimply Deſign'd the giving of every Animal, the moſt Advantageous Structure that could be deviſ'd, it ſeems that He ſhould have Made no Other Animals than Men. But then there could not have been that Diverſity of Contrivance among Living *Automata*, that does ſo much recommend the Wiſdom of Him, that could Frame ſo Many and ſo Differing Animals, tho' not All of them equally Perfect, yet All of them admirably Furniſh'd for thoſe Purpoſes to which He Deſtinated them. And therefore it does not argue any Want of Providence, that He has not Furniſh'd Man with Wings, as he hath Birds; nor Fiſhes with four Feet; nor Birds with Fins and Scales: becauſe theſe Parts would have been either Superfluous and Burthenſom, or would not have Suited with his Deſign, of making Some Animals Live on the Earth, and Some in the Water: And if He Deſign'd any to Live, tho' not equally, in Both, He furniſh'd Them with Parts of a Peculiar Structure, as I have elſewhere noted of the *Beaver* and the *Frog*. If it were not for the forementioned Conſideration, 'twould be hard to give a Reaſon, why Vegetables were not made the Food of all Animals; But Some ſhould be Carnivorous, and furniſh'd with Appetites and Organs to Devour Others, and Live, as Birds and Beaſts of Prey do, upon the Deſtruction of the Weaker. And 'twill be hard to ſhew, why, even in Animals of the ſame Kind, the Safety of Some ſhould be ſo much better Provided for than that of Others; as We ſee, that ſome Ants, and ſome Glow-worms, are Furniſh'd with Wings; and Some not. And in Mankind itſelf, Thoſe of the Female Sex are not ſo happily Fram'd, in order to their own Welfare, as Thoſe of the Maſculine: Since the Womb, and other Things peculiar to Women, which are not Neceſſary to the Good of Individual Perſons, but to the Propagation of their *Species*, ſubject that tender Sex to a whole Set of Diſeaſes, belonging to them either peculiarly, as they are Women, or as they are with Child, or brought to Bed; from all which Men are exempt. So that, to apply theſe Things to Our preſent Purpoſe; Men may ſometimes Miſtake, when they peremptorily Conclude, that This or That Part of an Animal Muſt, or Cannot, have been Fram'd for ſuch an Uſe, without Conſidering the *Coſmical*, and therefore Primary and Over-ruling, Ends, that may have been Deſign'd by *Nature* in the Conſtruction of the whole Animal.

Secondly, Men ſometimes erroneouſly Conclude, that ſuch an Office cannot belong to ſuch a Part, becauſe they think, It is not ſo Commodiouſly Framed for it, as may be wiſh'd or devis'd; without conſidering, *whether* the Structure which they Fancy would do Better for that Particular Uſe, would not, in ſome Other as conſiderable Regard, Oppoſe the Welfare of the Animal: Or, *whether* it would be conſiſtent with the Other Uſes deſign'd by Nature in that ſort of Living Creatures. For in the Living Works of ſo Excellent an Ingeneer as *Nature*, it muſt not be expected, that any Particular End ſhould be proſecuted to the Prejudice of the Whole; but rather it muſt be ſuppos'd, that She Aims not only at Particular Expedients, but Univerſal Symmetry; and does indeed excellently Fit the ſeveral Parts, for their reſpective Offices; but yet only as far forth as a due Regard to the Deſign and Welfare of the Whole will permit. The Reaſonableneſs of this Obſervation, One need but be moderately Exercis'd in *Zootomy* (as That is diſtinguiſh'd from *Androtomy*) to diſcern. For, *tho*' Man be confeſs'd to be the moſt Perfectly Fram'd Animal in the World; *yet*, His Body is not made the Model, on which Nature has Fram'd the Correſpondent Parts of Other Animals. The Lungs of Dogs, of Birds, of Frogs and Vipers, and I know not how many Others, are of a Structure very differing from Thoſe of Man. He is not furniſh'd with ſo many Stomachs as an Oxe or a Sheep, becauſe *Nature* Intended not He ſhould Ruminate like Them. *Tho*' His Gall be lodg'd in a peculiar Bag, ſo Plac'd in the Liver, as to give *Helmont* a colour to call it *Nucleus Hepatis*; *yet* 'twere unadvis'd to ſay, That the Secretion of Gall is none of the Uſes of Thoſe Livers, wherein Such a *Cyſtis* is not to be met with: Since in Some Amals,

mals, as in Horſes and Pigeons, that Bitter Humour, (which in *Frogs* I have often oberved to be of a Deep and Tranſparent Green,) is not uſually, as in Man, collected into one Bag: And in *Vipers*, tho' it be included in one *Cyſtis*, yet, as far as I have obſerved, That Bag does not at all touch the Liver: And ſtore of ſuch Inſtances may be met with among the Remarks of Zootomiſts: Wherefore I paſs on to Obſerve,

That, in the *Third* place, 'Tis Difficult to Determine the True and Primary Uſe of a Part, becauſe *Nature* does often Fit One Part for Several Uſes. To which I ſhall add,

In the *Fourth* place, That the Difficulty is ſometimes Increas'd, becauſe Nature may compaſs the Same End by Several Means, each of them Sufficiently, tho' not Equally, Commodious. I joyn theſe Two together, becauſe in Effect they do often Concur, in making it Difficult to determin the True Uſe of a Part. And the latter of the Two is ſometimes Increas'd by this, that Nature does not as Conſtantly, as ſome Men preſume She does, Imploy only one Part to perform ſuch an Office; but the Intended Effect is ſometimes produc'd by a *Series* of ſucceſſive Operations, to which ſeveral Parts may in Differing manners Contribute.

And here I obſerve, (what perhaps has not been Conſider'd,) that neither the Mechaniſm of a Human Body, nor that of very Conſiderable Parts of It, is to be judg'd of, only by the Structure of the Viſible Parts, whether they be thoſe Solid or Stable Ones that the Anatomiſt's Knife is wont to expoſe to Sight; or even by the Texture of thoſe Fluid Ones, which are to be found in the Veſſels and Cavities of a Dead Body when Diſſected, tho' never ſo Skilfully. For I take the

Body of a Living Man to be a very Compounded Engine, ſuch as Mechanicians would call *Hydraulico-Pneumatical* : Many of whoſe Functions, (if not the Chiefeſt,) are perform'd, not by the *Blood* and other *Viſible Fluids* barely as they are Liquors; but *partly* by their Circulating and other Motions; and *partly* by a very Agile and Inviſible ſort of Fluids, call'd *Spirits*, Vital and Animal; and *partly* perhaps, (as I have ſometimes gues'd,) by little *Springy Particles*; and perhaps too, by ſomewhat that may be call'd *the Vital Portion of the Air*; and by Things Analogous to *Local Ferments* : the Important Operations of all which are wont to Ceaſe with Life, and the Agents themſelves are not to be Diſcern'd in a Dead Body. So that, beſides thoſe Manifeſt Uſes, which the Viſible Fabrick of the Engine may ſuggeſt to an Anatomiſt; there may be Chymical Uſes (if I may ſo call them) of ſome Parts, that ſerve for the Elaboration of Spirits and other Fluids: Which Uſes, (as 'twas formerly Obſerv'd, and yet ought to be Inculcated,) are not ſuggeſted to the Anatomiſts, as Such, by the Inſpection of the Structure of the Parts; but to Diſcern them may require no mean Skill in Spagyrical Principles and Operations.

Such Conſiderations as the foregoing, make me think it more difficult than many do, to determin with any certainty the Main Uſe of divers Particular Parts, [for in ſome Others it ſeems manifeſt enough;] eſpecially if it be done with the Excluſion of Other Uſes. Nor is it enough, to Secure us that we know the Chief Function and End of a Part, to Know that it is contrived for ſuch a Purpoſe. For upon the things I have lately repreſented, One may ground this Anſwer, that this Fitneſs hinders not, but that the Primary Uſe of the

Part may be another, (as not Anatomical but Chymical, or *Vice Verſa*,) more Conducive to the General Welfare of the Animal, or elſe to the Coſmical Ends of Nature. And it ought not to ſeem Strange, that ſome Pieces of Workmanſhip, that conſiſt of many Parts, all of them Curiouſly Contriv'd, may by One Learned Man be gueſs'd to be Intended for This Uſe, and by Others for That Uſe, and yet Both theſe Uſes may be worthy of the Artificer.

When ſome very Politick Prince does ſome Great Thing, without declaring *Why*; the Gueſſes of the States Men are often very differing, whilſt yet none of them aſcribe to Him a Deſign miſ-becoming a Wiſe Man. And ſo, when a Learned Author Expreſſes himſelf, as ſometimes it happens, Ambiguouſly, tho' One Reader Interprets his words to This Senſe, and Another to That, yet Both the

Senſes pitch'd on, may fairly comport with the Context, and the main Scope of the Writer. Theſe things, I ſay, becauſe I would by no means Diſparage the Wiſdom of Nature, by propoſing the Difficulties I have hitherto mentioned; tho' I confeſs, *that*, upon the account of Theſe and ſome Others, I look upon many of the Arguments that ſeveral Authors have made bold to draw from *Final Cauſes*, but as Conjectural Things. And in divers Caſes, I allow what is ſuggeſted to me upon the Suppoſition of the Intended Uſes of Particular Parts, rather as good Hints to Excite, and give ſome Aim to, a Severer Inquiry, than as ſafe Grounds to build Phyſical Concluſions on.

PROP. V.

I come now to the Laſt Caution I would recommend to you, about the Conſideration of *Final Cauſes*; and I ſhall preſent it you in this Propoſition: *That the Naturaliſt ſhould not ſuffer the Search or the Diſcovery of a* Final Cauſe *of Nature's Works, to make him Undervalue or Neglect the ſtudious Indagation of their Efficient Cauſes.*

'TIs true, that to Inquire, To what Purpoſe Nature would have ſuch or ſuch Effects produc'd, is a Curioſity worthy of a *Rational Creature*, upon the ſcore of his being *ſo*. But this is not the proper Task of a *Naturaliſt*, whoſe Work, as he is Such, is not ſo much to Diſcover *why*, as *how*, Particular

Effects are Produc'd. A Country-Fellow here in *England* knows ſomething of a Watch, becauſe he is able to tell you, that 'tis an Inſtrument that an Artificer made to Meaſure Time by: and That is more than every *American* Savage would be able to tell you; and more than thoſe Civiliz'd *Chineſes* knew, that took the firſt Watch the Jeſuit brought thither, for a Living Creature. But the *Engliſh* Countryman, that knows no more of a Watch, than that 'twas made to ſhew the Hour of the Day, does very little underſtand the Nature of It. And whereas the two Scopes, that Men are wont to Aim at in the Study of Phyſicks, are to Underſtand, *how* and after what manner Nature Produces the *Phænomenon* we Contemplate; and, in caſe it be Imitable by Us, *how* We may, if Occaſion require, Produce the Like Effect, or come as Near it as may be: Theſe Ends cannot be attained by the bare Knowledg of the Final Cauſes of Things, nor of the General Efficient. But to Anſwer thoſe Aims, we muſt know the Particular Efficients, and the Manner and Progreſs of their Operating, and what Diſpoſitions they either Find or Produce in the Matter they work upon: as, He that would throughly underſtand the Nature of a Watch, muſt not reſt ſatisfied with knowing in General, that a Man Made it, and that he Made it for ſuch Uſes; but he muſt Particularly know, of what Materials, the Spring, the Wheels, the String or Chain, and the Ballance, are made: He muſt know the Number of the Wheels, their Bigneſs, their Shape, their Situation and Connexion in the Engine, and after what manner One Part Moves the Other in the whole *Series* of Motions, from the Expanſive Endeavour of the *Spring*, to the Motion of the *Index* that Points at the Hours. And much more muſt a

Mechanician know this, if he means to be able to Make a Watch Himſelf, or Give ſufficient Inſtructions to Another Man, that is more Handy, to do it for him. In ſhort, the Neglect of *Efficient Cauſes* would render Phyſiology Uſeleſs: But the ſtudious Indagation of them, will not Prejudice the Contemplation of *Final Cauſes*. For, ſince 'tis Truly ſaid, if it be rightly underſtood, that *Opus Naturæ eſt opus Intelligentiæ*; the Wiſe Author of Nature has ſo excellently Contriv'd the Univerſe, that the more Clearly and Particularly we Diſcern, how Congruous the Means are to the Ends to be obtain'd by them, the more Plainly we Diſcern the Admirable Wiſdom of the Omniſcient Author of Things; of whom it is Truly ſaid by a Prophet, that *He is Wonderful in Counſel, and Excellent in Working*. Iſa. 20. 29. Nor will the Sufficiency of the Intermediate

Cauſes, make it needleſs to admit a Firſt and Supreme Cauſe: Since (to inculcate on this Occaſion what I more fully deliver in another Paper,) That Order of Things, by vertue of which theſe Means become ſufficient to ſuch Ends, muſt have been at firſt Inſtituted by an Intelligent Cauſe. And if it be Irrational to Aſcribe the Excellent Fabrick of the Univerſe, *ſuch as it now is*, and the Actions that have manifeſt Tendencies to Determinate Uſeful Ends, To ſo Blind a Cauſe as *Chance*; it will be rather More than Leſs Irrational, to Aſcribe to *Chance* the *Firſt Formation* of the Univerſe, of which the Preſent State of Things is but the Natural Conſequence or Effect. For it may indeed be plauſibly ſaid, that in *the Preſent State of Things*, the ſeveral Patts of the Univerſe are by the Contrivance of the Whole *determin'd*, and thereby *qualify'd*, to Attain their Ends. But it cannot be Rationally Pretended, that at the *Firſt Framing of the World*, there was a *Sufficiency* in the Stupid Materials of It, without any *Particular* Guidance of a moſt Wiſe Superintendent, to Frame Bodies ſo Excellently Contriv'd and Fitted to their reſpective Ends.

THE CONCLUSION.

THE Reſult of what has been hitherto Diſcours'd, upon the Four Queſtions Propos'd at the Beginning of this Small Treatiſe, amounts in ſhort to this:

That all Conſideration of *Final Cauſes* is not to be Baniſh'd from Natural Philoſophy: but *that* 'tis rather Allowable, and in ſome Caſes Commendable, to Obſerve and Argue from the Manifeſt Uſes of Things, that the Author of Nature Pre-ordain'd thoſe Ends and Uſes.

That the Sun, Moon, and other Cœleſtial Bodies, excellently Declare the Power and Wiſdom, and conſequently the Glory of God; and were Some of Them, among Other Purpoſes, made to be Serviceable to Man.

That from the Suppoſed Ends of Inanimate Bodies, whether Cœleſtial or Sublunary, 'tis very Unſafe to Draw Arguments to Prove the Particular Nature of Thoſe Bodies, or the True Syſtem of the Univerſe.

That as to Animals, and the more Perfect Sorts of Vegetables; 'tis Warrantable, not Preſumptuous, to Say, That ſuch and ſuch Parts were Pre-ordained to ſuch and ſuch Uſes, relating to the Welfare of the Animal (or Plant) itſelf, or the *Species* it belongs to: But *that* Such Arguments may eaſily Deceive, if Thoſe that Frame them are not very Cautious, and Careful to avoid Miſtaking, among the various Ends that Nature may have in the Contrivance of an Animal's Body, and the various Ways which ſhe may ſucceſsfully take to compaſs the ſame Ends. And,

That however, a *Naturaliſt*, who would Deſerve that Name, muſt not let the Search or Knowledge of *Final Cauſes*, make him Neglect the Induſtrious Indagation of *Efficients*.

FINIS.

SOME UNCOMMON OBSERVATIONS ABOUT VITIATED SIGHT.

* * *

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Advertiſement.

THe Following Obſervations were not written, with Intention that they Should be Annex'd to the Foregoing Eſſay, but to Gratify a Philoſophical Phyſician. Which is the Reaſon why, beſides thoſe things that are more purely Optical, I thought fit to mention Some Others, that might be either Uſeful or

Grateful to an Inquiſitive Man of his Profeſſion. But having allow'dt he Stationer to Expect, that this Book, tho' it have for Title but an Eſſay, *ſhould not be of too inconſiderable a Bulk; I made choice of theſe Papers, among Several that lay by me, to increaſe the Bigneſs of the Book, Becauſe that, the Eyes being thoſe Parts of the Bodies of Men and other Animals, that I pitch'd upon in the Foregoing Treatiſe, to Strengthen the Doctrine deliver'd in it about Final Cauſes;*

Cauſes; it ſeem'd Suitable Enough to my Subject and Deſign, to mention ſome Uncommon Things that related to Viſion or the Organs of it, that We may be invited both *to Admire the Wiſdom of God, which, to furniſh Man with a Senſe that requires the Concourſe of ſo very many things, has, if I may ſo ſpeak, Crowded them into ſo Small an Engine as an Eye;* and *to Celebrate his Goodneſs too, which has been Diſplay'd in that, notwithſtanding that the Eye is ſo very Compounded*

pounded a Part, and the Sight ſo eaſily Vitiated yet the moſt part of Men by far do, from their Cradles to their Graves, enjoy the Beneſit and Comfort of ſo Neceſſary and Noble a Senſe.

OBSERVATIONS ABOUT VITIATED SIGHT:

OBSERV I.

EXamining a Gentleman, that was already Almoſt Blind, and fear'd to grow Altogether ſo, about the Symptoms of his Diſeaſe, (which came with a Stroke upon his Head) I found, as I expected, by his Anſwers, that, tho' he could not any thing well diſtinguiſh Objects of Other Colors, Yet he could well perceive thoſe that were White, to be of That Colour. Which confirms what I mention in the Hiſtory of Colours, concerning the great Quantity of Light, that is Reflected by White Objects, in compariſon of thoſe that are otherwiſe Colour'd. And this Obſervation it Self was confirm'd by another Patient, who, tho' almoſt Blind, could yet diſcern White Objects.

OBSERV. II.

I Knew a Gentleman that had a Cataract growing, which, when I look'd on his Eye in a lightſom place, appear'd to cover almoſt juſt the Upper Part of the Pupil; and tho' He were a Young Vigorous Perſon, and the Weather was very Clear, he could not well diſcern Men from Women croſs the Street. But this Gentlemans Misfortune came by a great Stroke he received on that Side of his Head, whereof he ſhew'd me the Scar;

which Circumſtance I therefore Note, becauſe when no Outward Violence has been offer'd to the Eye, it has been obſerved by a good Oculiſt, and, if I miſremember not, I have Seen an Inſtance of it, That a ſmall Part of the Pupil, left uncover'd by the Cataract, would ſerve for more Sight than the Gentleman enjoy'd. In him likewiſe I had a further Confirmation, of what I was lately Obſerving about the Conſpicuouſneſs of White Objects. For tho' he could not, as I was ſaying, diſcern Men and Women that paſs'd by, on the other Side of the Street, yet, having once deſired him to tell me, if he could diſtinguiſh any Object there, he told me that he could; and that I might no longer Doubt of it, when I asked him what he ſaw, he ſaid that it was a Woman that paſs'd by with a White Apron, which Apron he ſaw directly, and therefore might eaſily conclude, without diſtinctly ſeeing the

Wearer, that the Perſon that Wore it was a Woman.

OBSERV. III.

MEeting accidentally with a Man, by Profeſſion a Farrier, whoſe Eyes look'd very odly, I queſtioned him about his Diſtemper; and found by his anſwers, that he had had Cataracts in both his Eyes, but either had them ill Couch'd, or had not behaved himſelf orderly afterwards. For there Seemed ſtill to be ragged Films, that cover'd conſiderable portions of his Pupils; in ſo much that I ſomwhat wonder'd to ſee him go freely about, as he did, without requiring any body to help him, ſo much as up or down Stairs: and I hereupon asking him, whether he were able to Read in a large Print, he told me he was, with the help of his *Cataract Spectacles*, as they call them, which I doubting of, brought him a Book, whoſe Title Page he was not able to

Read; this he Excus'd by ſaying that the place was too Lightſom, which tho' it did not Seem to Others, yet, conſidering that it was about Noon, I caus'd the Room to be a little darken'd, and then perceived that indeed he could Read well Enough.

OBSERV. IV.

A Gentleman, having in a quarrel receiv'd a Stroke on one Side of his Head, which knock'd him down, found afterwards a great Weakneſs and dimneſs in his Eyes; into which when I look'd attentively, I plainly diſcern'd, that *tho'* above one half of his Pupil was yet uncover'd, ſo that when he look'd downwards, he could See well enough with That Eye, *yet* there was grown in it no leſs than two Cataracts, which, when I look'd on them attentively, and in a good Light, I could manifeſtly perceive to be Diſtinct; the One of them ſeeming to be ſmooth ſ pread, as if its Circular Edge adher'd cloſely to the inſide of the Eye;and the Other, that ſeem'd not altogether of the ſame Colour, hanging looſely, and as it were a Rag, at ſome diſtance above it. What afterwards became of this Gedtleman I could not learn, tho' I would gladly have done it; Two Cataracts at a time in one Eye being ſome what Extraordinary.

OBSFRV. V.

A Learned Gentleman coming once to viſit me, with deſign, as I afterward's perceive'd, to hear my Opinion concerning an odd Diſtemper he had in his Eyes; I found, by Diſcourſing with him concerning the *Phænomena* of his Diſeaſe, that *tho'*, when he look'd on Objects near at hand, he Saw them ſomewhat Dimly, but yet Single, *yet*, there were ſome Objects, particularly Poſts and Rails, which, when he beheld at a certain diſtance (which was not very great) they appear'd to him both more Dark and Double. I found alſo that he complained of divers Black Flyes and litle Leaves, that paſs'd now and then before his Eyes ; which, *tho'* they do not always fore-bode a True Cataract, ſince Others and I alſo have obſerv'd them to continue many years without being more than a *Baſtard Suffuſion* (as Phyſicians Speake) *yet* in him they were probably Forerunners of a True Cataract ; in regard that I have known it obſerv'd by a skilful Oculiſt, that ſome Perſons, before their Cataract, have complain'd that at ſome Diſtances they ſaw Objects almoſt Double; ſo that looking at ones Head, they thought they Saw a great part of a Dark Head a little above it: which Deſcription, whether it proceeded from ſome Refractions made by the yet not Uniformly Opacous Matter of the Cataract , not having opportunity to examine thoſe Perſons my ſelf, I dare not Venture to ſay.

OBSERV. VI.

IT may be worth Obſerving, How long The better ſort of Cataracts, tho' they hinder Sight for a time, as a thick Curtain drawn croſs the Pupil, yet may remain in the Eye, without Spoiling the Optic Nerve or hindring Viſion when once the Cataract is remov'd; Of which I remember, among other Inſtances, I took notice in the Caſe of a Woman, who told me ſhe had Cataracts in her Eyes ſo long, that ſhe was brought a Bed of Six Children conſecutively, without being able to See any one of them, till after ſhe was Cur'd by having the Cataracts Couched. But then ſhe ſaw ſo well, that with Spectacles ſhe could read in a portable Bible of a ſmall Print. And divers conſiderable Perſons of my Acquaintance ſaw One of Eighteen years Old, born with Cataracts in both her Eyes, Who not naturally Wanting the Faculty of Seeing, tho' thus Hinder'd of the Exerciſe of it, had been ſo happily Couched, as afterwards to have the benefit of Sight in them both.

OBSERV. VII.

IT has been of late the Opinion of very Learned men, that tho Both our Eyes be Open and turn'd towards an Object, yet 'tis but One of them at a time that is effectually Imployed in giving us the Repreſentation of it. Which Opinion, in this place where I am writing but Obſervations, it were not proper to Diſcuſs; eſpecially becauſe what is ſuppos'd to be Obſerv'd, will not always Uniformly happen, but may much Vary in particular Perſons, according to their ſeveral Cuſtoms, and the Conſtitution of their Eyes. For I have, by an Experiment purpoſely made, ſeveral times found, that my Two Eyes Together ſee an Object in another Situation, than Either of them Apart would do. On the other ſide; I met with a Perſon, who told me he had a Cataract in his Eye for two Years, without diſcerning that he had any ſuch Impediment in either of his Eyes; and when I ask'd him, how he knew that, he anſwer'd me, that others had taken notice of a white Filme that croſs'd his Eye, ſo long before he himſelf did. But not knowing what a Cataract was, and not finding him to complain of it at all himſelf, the Thing remain'd unheeded, till the Patient, having one day occaſion to Rub his Sound Eye, whilſt the Lid cover'd it, was ſadly Surpriz'd to find himſelf altogether in the Dark; and then reſorting to an Oculiſt, was aſſur'd it was a Cataract, which, a while before I met with him, had been Couch'd. But notwithſtanding this Relation, what I had try'd about the Uſing of Both Eyes, made me ask of a very Ingenious Perſon, that by an Accident had ſome months before one of his Eyes ſtruck out, whether he did not obſerve, that upon the being confin'd to the uſe of One Eye he was apt to miſtake the Situation and Diſtances of things. To which he anſwer'd me, that haveing frequently occaſion to pour Diſtill'd Waters and other Liquors out of one Vial into an other, after this Accident he often Spilt his Liquors, by pouring quite Beſides the necks of the Vials he thought he was pouring them directly Into. Afterwards inquiring of a Gentleman that was a Goodfellow, and had by a Wound a while before loſt the uſe of One of his Eyes; he confeſs'd to me, that divers times pouring the Wine out of one Veſſel into another, he would miſs the Orifice of the Bottle or Glaſs that ſhould receive it, and expoſe himſelf to the merriment of the Company. A yet more conſiderable Inſtance of Such Miſtakes, I afterwards had from a Noble Perſon, who having in a Fight, where he play'd the *Hero*, had one of his Eyes ſtrangely Shot out, by a Musquet-Bullet that came out at his Mouth; anſwer'd me, that not only he could not well Pour Drink out of one Veſſel into another, but had Broken many Glaſſes, by letting them fall out of His Hand, when he thought he had put them into Anothers, or ſet them down upon a Table. And he added, that this aptneſſe to misjudge of Diſtances and Situations continued with him, tho' not in the ſame Degree, for little leſs than Two Years. But on this occaſion I ſhall take notice that, I have often imployed a Dextrous Artificer, whoſe Right Eye (for in his Left there is nothing more remarkable) is conſtantly drawn ſo much a ſide towards the greater Angle of the Eye, that the Edge of the Pupil does almoſt touch it and one would think it ſcarce poſſible, but that he ſhould ſee the Object double with two Eyes that ſeem ſo very differingly turn'd; and yet he anſwer'd me, that he does not ſee at all, nor that he finds any Inconvenience, ſave the Deformity of this Unuſual Situation of his Right Eye, which hinders him not from Reading as freely as other Men. This Accident happend to him by an unwary Miſtake of Sublimate for another thing; after which, it ſeems one of the Muſcles that mov'd the Eye, remain'd Contracted. But this having happen'd to him, as I found by Inquiry, ever ſince he was two Years of Age; he could not remember whether he had ſeen Objects Double, before he was accuſtom'd to judge of them by the help of his other Senſes, and the Information of Others.

OBSERV. VIII.

IT may be worth while to Obſerve, that a very great Diſtention may be made of the Parts of the

Eye, without Spoiling the Sight; of which I lately ſaw an Inſtance in a Patient of that Ingenious and Experienced Oculiſt, Dr. *Turbervill.* This was a Gentlewoman about one or two and twenty years of Age, Whoſe Complexion and Features would have made her Handſom, if ſhe had not had that ſort of Eyes, which tho' rarely met with, ſome call Ox-Eyes; for Hers were ſwell'd much beyond the ſize of Human Eyes, in ſo much, that ſhe complain'd, they often frighted thoſe that ſaw Her, and were indeed ſo Big, that ſhe could not move them to the Right Hand or the Left, but was conſtrain'd to look ſtrait forward; or if ſhe would ſee an Object that lay Aſide, ſhe was oblig'd to turn her Whole Head that way. And ſo ſhe anſwer'd me ſhe was, when ſhe ſet herſelf to Read in a Book, unleſs ſhe did with her Hand move the Book from one ſide to another, to bring the ends of the Lines directly before her Eyes. She told me her Eyes did not always retain the ſame meaſure of Tumidneſs, and that the very day I ſaw them, they had been in the Morning much more Swell'd than when I look'd upon Her. But that which was more remarkable, was, that not only ſhe could, for all this, See very well and diſtinctly, and, as I juſt now intimated, could Read Books, but her Sight had continued good, tho' ſhe had this Diſtemper theſe twelve years. And, which is more ſtrange, ſhe anſwer'd me, that her Viſive Power was ſo little Prejudic'd by this Diſtemper, when it firſt came upon her, that ſhe never knew any thing was amiſs in her Eyes, till her Friends told her of it, when they found it had continued too long to be a meerly Caſual and Tranſient Tumor. But, tho' this odd Accident did not Im, pair her Sight, it occaſion'd great Pains in her Eyes, for which ſhe took Purging and other Medicines, with ſo little Succeſs, that both ſhe and her former Phyſicians, thought her caſe Deſperate; there appearing no way of diſlodging a Humour ſo long ſettled there. Upon which I propos'd *Salivation*, as the leaſt unlikely way that remain'd, to Reſolve and carry off the Peccant Humour. But this, tho' much approv'd by her Doſtor, the Modeſt Patient would by no means conſent to.

OBSERV. IX.

I Once look'd into the Eyes of a Gentlewoman, where I could diſcern nothing that was Amiſs, or any thing that was unuſual, ſave the Narrowneſs of her Pupils, which is often eſteem'd a good Sign. And yet this Woman was much troubled with Fumes and Weakneſſes of the Head, and had a Diſaffection of Sight very Uncommon; for ſhe told me, that, whereas in the Day time her Sight was ſo Dimm that ſhe conld hardly diſcern her way; ſoon after Sun-ſet, and during the Twilight, ſhe could diſcern things far better. And in this Condition ſhe had continued a good while: In which odd Caſe, whether the ſmallneſs of her Pupils, which might poſſibly be Contracted too much by the Day-light, and might be Expanded by the Receſs of ſo much Light; or the greater Diſſipation of the Viſive Spirits at one time than at the other, may have any Intreſt, I ſhall not now ſtay to Enquire. But this Patient brings into my mind the rare Caſe of a Learned old Divine, who complain'd to me that he was forced to write his Letters and Books by Night, becauſe, during the Day-time, his Right Hand ſhook ſo much that he could not manage a Pen, and therefore was forc'd to make uſe of it only by Candle-light. And I remember that, upon his preſſing me to propoſe ſome Poſſible Cauſe of ſo odd a *Phænomenon*, I told him, to put him off, that perchance the few Animal Spirits that he had to Move his Hands with, were ſo Subtile as to be Diſſipated or Exhal'd by the Warmth of the Day, but were kept in by the Coldneſs of the Night, that ſomewhat conſtipated his Pores; and commended to him the uſe of ſtrengthning things, and, among the reſt, of Chocolate; which when for ſometime he had continu'd to drink; he came to me, and told me with joy, that he began again to be able to Write in the Day, and ſo I think he can do yet. But this upon the by.

OBSERV. X.

BEing acquainted with two Ladies of very diſtant Ages, but very near of Kin, who were both of them troubled with Diſtempers, that made me gueſs their Eyes might ſomtimes be oddly Affected, I Enquired of them, whether they were not troubled with ſudden Apparitions of Flame or Fire? to which one of them anſwer'd me, that oftentimes there would appear to her Multitudes, as ſhe fancied, of Sparks of Fire, that were very unwelcome to her. And the other Lady, that was ſubject to Convulſive, but not Epileptick, Fits, told me, ſhe divers times ſaw, as ſhe fancied, ſuch Flaſhes of Fire as I had mentioned, paſs before her Eyes, which at firſt did not a little Frighten her.

OBSERV. XI.

THe following Obſervation is odd enough, to give riſe to ſome curious Speculations and Diſputes: And therefore I choſe to ſet it down as I found it among my *Adverſaria*, tho' I ſuſpect part of it to have been loſt, that the Relation may be the more Unbiaſs'd, tho' if I had another opportunity to Diſcourſe with the Patient, I ſhould upon ſecond Thoughts, have ask'd ſome Queſtions, and Written down ſome Circumſtances, that I now wiſh had not been omitted.

The Gentlewoman I ſaw to day, ſeems to be about 18 or twenty years old, and is of a fine Complexion, accompanied with good Features. Looking into her Eyes, which are Gray, I could not diſcern any thing that was unuſual or amiſs; tho' her Eye-lids were ſomwhat Red, whether from Heat, or which ſeemed more likely, from her precedent Weeping. During the very little time that the Company allowed me to ſpeak with her, the Queſtions I propos'd to her were anſwered to this Effect.

That about five years ago, having been upon a certain Occaſion immoderately tormented with Bliſters, applied to her Neck and other Parts, ſhe was quit deprived of her ſight.

That ſometime after ſhe began to perceive the Light, but nothing by the help of it: That then ſhe could ſee a Window, without diſcerning the Panes or the Barrs: That afterwards ſhe grew able to diſtinguiſh the Shapes of Bodies, and ſome of their Colours: And that at laſt ſhe came to be able to ſee the Minuteſt Object; which when I ſeemed to doubt of, and preſented her a Book, ſhe not only without heſitancy Read in it a line or two, (fot her Eyes are quickly weary) but having pointed with my Finger at a part of the Margent, near which there was the part of a very little Speck, that might almoſt be covered with the point of a Pin; ſhe not only readily enough found it out, but ſhewed me at ſome diſtance off another Speck, that was yet more Minute, and required a ſharp Sight to Diſcern it. And yet, whereas this was done about Noon, ſhe told me, that ſhe could ſee much better in the Evening, than in any Lighter time of the day.

While ſhe was looking upon the Printed Paper I ſhew'd her, I ask'd her whether It did not appear White to her,and the Letters Black? To which ſhe anſwer'd' that they did ſo; but that ſhe ſaw as it were a White Glaſs laid over both the Objects. But the things that were moſt particular and odd in this womans caſe, were theſe two. The firſt is, that ſhe is not unfrequently troubled with flaſhes of Lightning,that ſeem to iſſue out like Flames about the External Angle of her Eye, which often make her ſtart, and put her into Frights and Melancholy Thoughts. But the other, which is more Strange and Singular, is this, that ſhe can diſtinguiſh ſome Colours, as Black and White, but is not able to diſtinguiſh others, eſpecially Red and Green: And when I brought her a Bag of a fine and gloſſie Red, with Tufts of Sky-colour'd Silk; ſhe look'd attentively upon it, but told me, that to her it did not ſeem Red, but of another Colour, which one would gueſs by her Deſcription to be a Dark or Dirty one: and the Tufts of Silk that were finely Colour'd, ſhe took in her Hand, and told me they ſeem'd to be a Light-colour, but could not tell me which; only ſhe compar'd it to the Colour of the Silken Stuff of the Lac'd Peticoat of a Lady that brought her to me; and indeed the Blews were very much alike. And when I ask'd her, whether in the Evenings, when ſhe went abroad to walk in the Fields, which ſhe much delighted to do, the Meadows did not appear to her Cloathed in Green? ſhe told me they did not, but ſeem'd to be of an odd Darkiſh Colour; and added, that when ſhe had a mind to gather Violets, tho' ſhe kneel'd in that Place where they grew, ſhe was not able to diſtinguiſh them by the Colour from the neighbouring Graſs, but only by the Shape, or by feeling them. And the Lady that was with her, took thence occaſion to tell me, that when ſhe looks upon a Turky Carpet, ſhe cannot diſtinguiſh the Colours, unleſs of thoſe parts that are White or Black. I ask'd the Lady whether ſhe were not troubled with Female Obſtructions? To which ſhe Anſwer'd me, ſhe was not now, but that formerly ſhe had been much ſubject to them, having been obſtinately troubled with the Green-ſickneſs.

OBSERV. XII.

I Shall add on this Occaſion ſomthing, that, tho' not ſo odd as It, has yet an Affinity with the newly recited Caſe, and ſo may make it the more Credible. And it is, That I lately convers'd with a Mathematician, Eminent for his skill in Opticks, and therefore a very competent Relator of *Phænomena* belonging to that Science? whoſe Organs of Viſion are ſo conſtituted, that, *tho'* in his Eyes I could diſcern nothing Amiſs, and *tho'* he makes much and excellent uſe of them in Aſtronomical Obſervations and Optical Experiments; yet he confeſſes to me, that there are ſome Colours that he conſtantly ſees Amiſs, and particularly Inſtanc'd in one, which in a clear day, (for ſo it was when we Diſcours'd together of this Matter) ſeem'd to him to be the ſame with that of a darkiſh ſort of Cloath that he then wore, whil'ſt to Me and Other Men, it appear'd of a quite differing Colour.

OBSERV. XIII.

DIſcourſing with a Lady, who had been very long troubled with a very Unuſual Indiſpoſition in her Head, and, tho' She looks well, is never without Pain in it; *tho'* looking into her Eyes, I perceived nothing Amiſs, yet conjecturing that ſo Obſtinate a Diſtemper muſt have had ſome Unuſual Influence upon her Sight; I learn'd by Inquiry that after the Violent Fits of Pain and Diſorder ſhe had from time to time in her Head, if ſhe did but caſt her Eyes, or turn them ſuddenly, from one ſide to the other, there would preſently enſue a Convulſive Motion in One of them, whereby it would not only be drawn away, but, which was very ſtrange, All White Things, and moſt other Objects, that ſhe look'd on with that Eye, appear'd Green to her: And yet this was not a Tranſient Diſcompoſure that would go quickly off, but would Moleſt her for a good while, and frequently Return'd upon her for a whole year; ſo that ſhe diſpaired of Recovering the uſe of that Eye, vvherevvith yet ſhe novv ſees very vvell, tho' her Cephalick Diſtempers vvere rather Mitagated than quite Cur'd. And vvhen I ask'd her, vvhether, vvhileſt the Convulſion of her Eye laſted, ſhe did not ſee Objects Double?

ble? She anſvver'd, that vvhileſt that Diſtemper vvas upon her, if ſhe vvent to Read in a Book, the Letters vvere ſo apt to appear Double, that when ſhe vvas bent upon Reading, ſhe vvas fain to ſhut the Diſtemper'd Eye, and Imploy only the Other.

OBSERV. XIV.

SOme may think that a Man has rather an Excellent, than a Vitiated Sight, who can See Objects with a far leſs degree of Light than other Men have need of to Diſcern them. But tho' an Extraordinary Tenderneſs may be a kind of Perfection in the Eyes of *Bats* and *Owls*, whoſe uſual Food may be more eaſily Purchaſed by Twilight: Yet as to Man, the main part of whoſe Actions is to be perform'd by the Light of the Day, or ſome other almoſt Equivalent; it may Argue the provident goodneſs of the Author of Nature, to have given Him Eyes Conſtituted as thoſe of

Men generally are: Since, That a very great Tenderneſs of the *Retina*, or principal part of the Organ of Sight, would be, if not an Imperfection, at leaſt a great Inconvenience, may appear by the Memorable Story I am going to Relate.

In the Army of the late King of Hapy Memory, (*Charles* the Firſt) there was a Gentleman of great Courage and good Parts, that was Major to one of the Regiments; who being afterwards by the prevailing Uſurpers forc'd to ſeek his Fortune abroad, ventur'd to do his King a piece of Service at *Madrid*, which was of an Extraordinary Nature and Conſequence, and there judg'd very Irregular. Upon this he was committed to an Uncommon Priſon, which, tho' otherwiſe Tolerable enough, had no Window at all belonging to it, but a Hole in the thickneſs of the Wall, at which the Keeper once or twice a day put in liberal proviſion of Victuals and Wine, and preſently Clos'd the Window, if it may be ſo call'd, on the Out-ſide, but not perhaps very Solicitouſly. For ſome Weeks this poor Gentleman continu'd in the Dark, very Diſconſolate. But afterwards he began to think he ſaw ſome little Glimering of Light, which from time to time Increaſed; inſomuch, that he could not only Diſcover the Parts of his Bed, and other ſuch large Objects, but at length came to Diſcover things ſo Minute, that he could Perceive the Mice that frequented his Chamber, to eat the Crumbs of Bread that fell upon the Ground, and Diſcern their Motions very well. Several other Effects of his Sight in that Dark Place He Related. And that which Confirms that this Proceeded mainly from the great Tenderneſs the Viſive Organ had acquired, by ſo long a ſtay in ſo Obſcure a Place, was, that when after ſome Months, the Face of Affairs Abroad being ſomwhat Chang'd, His Liberty was reſtor'd him, he durſt not leave his Priſon Abruptly, for fear of loſing his Sight by the Dazling Light of the Day; and therefore was fain to Accuſtom his Eyes by ſlow degrees to the Light. This Strange, as well as once Famous Story, I the leſs Scruple to ſet down in this Place, becauſe I had the Curioſity to learn it from the Gentleman's own Mouth, who acquainted me with other Particulars about it, that, for want of the Notes I then took, I ſhall not now venture to ſpeak of.

FINIS.

[illegible]

ERRATA.

PAge 5. line 4. read *Benefit*, l. 14. r. *hominis*, p. 14. l. 18. r. *Corporeal. I ſay not this*, p. 16. l.20. r. *Eye*, p.21. l.20. r. *ſcil ad Object*. p. 26. l. 2. r. *eu egare*, p.42. l. 6. r. συστροφὰς, p. 46. l. 24. r. *fortuitous*, p. 48. l. 26. r. *are brought*, p. 50. l. 1. r. *dilate*, l. 5. r. *any notice*, p. 53. l. 23. r. *Cornea*, p. 58. l. 20. r. *notably*, p. 59. l. 20. r. *Poſture*, p. 61. l. 10. r. *Cameleon*, l. 25. r. *ſlow*, p. 68. l. 17. r. *it was*, p. 79. l. 1. r. *it was not* p. 79. l. 17. r. הצדלים, p. 90. l. 27. r. *to be done*, p. 89. dele (;) p. 105. l. 15. r. *ſort*, p. 106. l. 2. r. *Queſtion ; about which*, p. 129. l. 27. r. *live*, p. 139. l. 14. dele *&* *L*. 1, 2. p. 143. l. 23. r. *Chance. The*, p. 151. l. 1. r. *Functions*, p. 172. l. 14. r. *produc'd*, p. 177. l. 5. r. *Inferiour*, l. 9. r. *ſeveral*, p. 198. r. *teres*, p. 199. l. 14. r. *craſſioris*.

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